

# 100% CONSTRUCTION SUBMITTAL

## PROJECT MANUAL VOLUME 1 OF 2

DIVISIONS 00 THRU 13

VA ROSEBURG HEALTHCARE SYSTEM

Seismic Replacement Building 2  
Phase 1 Minor / Project 653-322  
Acute Psychiatric Ward



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**SECTION 01 00 00**  
**GENERAL REQUIREMENTS**

**1.1 GENERAL INTENTION**

- A. Contractor shall completely prepare site for building operations, including demolition and removal of any existing materials on Site , and furnish labor and materials and perform work for the Construction of a New Seismic Replacement Building 2, Phase 1 Minor / Project 653-322 Acute Psychiatric Ward as required by Construction Documents.
- B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer
- C. Offices of Tina Ely, Architect, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.
- D. Training:
  - 1. All employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team.
  - 2. Superintendent shall have the 30-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team.
  - 3. Submit training records of all such employees for approval before the start of work.

**1.2 STATEMENT OF BID ITEM(S)**

- A. ITEM I, GENERAL CONSTRUCTION: Work includes general construction, walks, grading, drainage, mechanical and electrical work, utility systems,
- B. ALTERNATES: Description of Alternates are identified in Appendix at rear of Specification Manual.

**1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR**

- A. AFTER AWARD OF CONTRACT, 3 sets of specifications and drawings will be furnished. These drawings and specifications will be available to the Contractor electronically .

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**GENERAL REQUIREMENTS**

- B. Additional sets of drawings may be made by the Contractor, at Contractor's expense, from the electronic copies available, furnished by Issuing Office. Such prints shall be returned to the Issuing Office immediately after printing is completed.

**1.4 CONSTRUCTION SECURITY REQUIREMENTS**

A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

**1.4 CONSTRUCTION SECURITY REQUIREMENTS (CONT)**

B. Security Procedures:

1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site. They will all enter thru the Police Station, near the Project Site.
2. For working outside the "regular hours" as defined in the contract, The General Contractor shall give 3 days notice to the Contracting Officer so that security arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the Contracting Officer.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the Resident Engineer for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.
2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for

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permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

**D. Motor Vehicle Restrictions**

1. Separate permits shall be issued for General Contractor and its employees for parking in designated areas only.

**1.5 FIRE SAFETY**

- A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

1. American Society for Testing and Materials (ASTM):

E84-2009 .....Surface Burning Characteristics of Building Materials

2. National Fire Protection Association (NFPA):

10-2010.....Standard for Portable Fire Extinguishers

30-2008.....Flammable and Combustible Liquids Code

51B-2009 .....Standard for Fire Prevention During Welding, Cutting and Other Hot Work

70-2011.....National Electrical Code

241-2009.....Standard for Safeguarding Construction, Alteration, and Demolition Operations

3. Occupational Safety and Health Administration (OSHA):

29 CFR 1926 .....Safety and Health Regulations for Construction

- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Resident Engineer and Facility Safety Officer for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the

**1.5 FIRE SAFETY (CONT)**

construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the Resident Engineer that individuals have undergone contractor's safety briefing.

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- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and  
  
for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings  
  
and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Resident Project Engineer and facility Safety Officer.
- G. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- H. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- I. Sprinklers: Install, test and activate new automatic sprinklers.
- J. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Resident Project Engineer . Obtain permits from facility Safety Manager Officer at least 24 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.
- K. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Resident Project Engineer and facility Safety Officer .
- L. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- M. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

**1.6 OPERATIONS AND STORAGE AREAS**

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary

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buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall

**1.6 OPERATIONS AND STORAGE AREAS (CONT)**

not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

**(FAR 52.236-10)**

- D. Working space and space available for storing materials shall be as shown on the drawings or as determined by the Resident Engineer.
- E. Workmen are subject to rules of Medical Center applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others.
1. Do not store materials and equipment in other than assigned areas.
  2. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.
- G. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by Resident Engineer. All such actions shall be coordinated with the Utility Company involved:
1. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- H. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and

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padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by Resident Engineer.

- I. Utilities Services: Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by Resident Engineer.
1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of Resident Engineer. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Medical Center Director's prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.

**1.6 OPERATIONS AND STORAGE AREAS (CONT)**

2. Contractor shall submit a request to interrupt any such services to Resident Engineer, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior  
to the desired time and shall be performed as directed by the Resident Engineer.
5. In case of a contract construction emergency, service will be interrupted on approval of Resident  
Engineer. Such approval will be confirmed in writing as soon as practical.
6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.



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- J. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
  - 1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times.
  - 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the Resident Engineer.
- K. Coordinate the work for this contract with other construction operations as directed by Resident Engineer. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

**1.7 INFECTION PREVENTION MEASURES**

- A. Implement the requirements of RVAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program with in the Building as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group as specified here. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to Resident Project Engineer for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  - 1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- C. Medical center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality.

**1.7 INFECTION PREVENTION MEASURES (CONT)**

In addition:

- 1. The RE and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement corrective measures to restore proper pressure differentials as needed.

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2. In case of any problem, the medical center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.
- D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold. Dampen debris to keep down dust.
- E. Final Cleanup:
  1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
  2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
  3. All new air ducts shall be cleaned prior to final inspection.

**1.8 PROTECTION OF EXISTING VEGETATION, UTILITIES, AND IMPROVEMENTS**

- A. The Contractor shall preserve and protect all vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing utilities at or near the work site, the locations of which are made known to or should be known by the Contractor. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

**(FAR 52.236-9)**

- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.
- D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate medical center) office. The apparent low bidder, contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and permit requirements. Many of the permit requirements will be satisfied by completing construction as shown and specified. Some requirements involve the Contractor's method of operations and operations planning and the Contractor is responsible for

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**1.8 PROTECTION OF EXISTING VEGETATION, UTILITIES, AND IMPROVEMENTS (CONT)**

employing best management practices. The affected activities often include, but are not limited to the following:

- Designating areas for equipment maintenance and repair;
- Providing waste receptacles at convenient locations and provide regular collection of wastes;
- Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
- Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
- Providing adequately maintained sanitary facilities.

**1.9 PHYSICAL DATA**

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by \_\_\_\_\_.
- (FAR 52.236-4)**
- B. Subsurface conditions have been developed by core borings and test pits. Logs of subsurface exploration are shown diagrammatically on drawings.
- C. A copy of the soil report will be made available for inspection by bidders upon request to the Engineering Officer at the VA Medical Center.
- D. Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work and logs of borings; and, after investigation, decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site.

**1.10 PROFESSIONAL SURVEYING SERVICES**

A registered professional land surveyor or registered civil engineer whose services are retained and paid for by the Contractor shall perform services specified herein and in other specification

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sections. The Contractor shall certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this contract.

**1.11 LAYOUT OF WORK**

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to

**1.11 LAYOUT OF WORK (CONT)**

remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

**(FAR 52.236-17)**

- B. Establish and plainly mark center lines for building, and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for structure, roads, parking lots, are in accordance with lines and elevations shown on contract drawings.
- C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey shall include, but not be limited to, location of lines and grades of footings, exterior walls, center lines of columns in both directions, major utilities and elevations of floor slabs:
1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the Resident Engineer before any work (such as footings, floor slabs, columns, walls, utilities and other major controlling features) is placed.
- D. During progress of work, Contractor shall have line grades and plumbness of all major form work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the Resident Engineer before any major items of concrete work are placed. In addition, Contractor shall also furnish to the Resident Engineer certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.

1. Lines of building .

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2. Elevations of bottoms of footings and top of floor of building.
3. Lines and elevations of sewers and of all outside distribution systems.
- E. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to Resident Engineer.
- F. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

**1.12 AS-BUILT DRAWINGS**

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the Resident Engineer's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the Resident Engineer within 15 calendar days after each completed phase and after the acceptance of the project by the Resident Engineer.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

**1.13 USE OF ROADWAYS**

- A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the Resident Engineer, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.
- B. When new permanent roads are to be a part of this contract, Contractor may construct them immediately for use to facilitate building operations. These roads may be used by all who have business thereon within zone of building operations.

**1.14 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT**

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:
  1. Permission to use each unit or system must be given by Resident Engineer. If the equipment is not installed and maintained in accordance with the following provisions, the Resident Engineer will withdraw permission for use of the equipment.

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2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
  3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
  4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
  5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
  6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

**1.14 TEMPORARY TOILETS**

- A. Provide where directed, (for use of all Contractor's workmen) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by Resident Engineer, provide suitable dry closets where directed. Keep such places clean and free from flies, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

**1.15 AVAILABILITY AND USE OF UTILITY SERVICES**

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the

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purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

- C. Contractor shall install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.
- D. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:
  - 1. Obtain heat by connecting to Medical Center heating distribution system.
    - a. Steam is available at no cost to Contractor.
- E. Electricity (for Construction and Testing): Furnish all temporary electric services.
  - 1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
- F. Water (for Construction and Testing): Furnish temporary water service.
  - 1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.
  - 2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at Resident Engineer's discretion) of use of water from Medical Center's system.
- G. Steam: Furnish steam system for testing required in various sections of specifications.
  - 1. Obtain steam for testing by connecting to the Medical steam distribution system. Steam is available at no cost to the Contractor.
  - 2. Maintain connections, pipe, fittings and fixtures and conserve steam-use so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at Resident Engineer's discretion), of use of steam from the Medical Center's system.
- H. Fuel: Natural and LP gas and burner fuel oil required for boiler cleaning, normal initial boiler-burner setup and adjusting, and for performing the specified boiler tests will be furnished by the Government. Fuel required for prolonged boiler-burner setup, adjustments, or modifications due to improper design or operation of boiler, burner, or control devices shall be furnished by the Contractor at Contractor's expense.

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**1.16 NEW TELEPHONE EQUIPMENT**

The contractor shall coordinate with the work of installation of telephone equipment by others. This work shall be completed before the building is turned over to VA.

**1.17 TESTS**

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a complex which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

**1.18 INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the Resident Engineer coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being



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furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All

**1.18 INSTRUCTIONS (CONT)**

instruction periods shall be at such times as scheduled by the Resident Engineer and shall be considered concluded only when the Resident Engineer is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the Resident Engineer, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

**1.19 GOVERNMENT-FURNISHED PROPERTY**

- A. The Government shall deliver to the Contractor, the Government-furnished property shown on the drawings.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.
- C. Contractor shall be prepared to receive this equipment from Government and store or place such equipment not less than 90 days before Completion Date of project.
- D. Notify Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.
1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
  2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Government.
- E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and

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the like) necessary to make the connection between the Government furnished equipment item and the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.

- F. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.
- G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

**1.19 CONSTRUCTION SIGN**

- A. Provide a Construction Sign where directed by the Resident Engineer. All wood members shall be of framing lumber. Cover sign frame with 0.7 mm (24 gage) galvanized sheet steel nailed securely around edges and on all bearings. Provide three 100 by 100 mm (4 inch by 4 inch) posts (or equivalent round posts) set 1200 mm (four feet) into ground. Set bottom of sign level at 900 mm (three feet) above ground and secure to posts with through bolts. Make posts full height of sign. Brace posts with 50 x 100 mm (two by four inch) material as directed.
- B. Paint all surfaces of sign and posts two coats of white gloss paint. Border and letters shall be of black gloss paint, except project title which shall be blue gloss paint.
- C. Maintain sign and remove it when directed by the Resident Engineer.

**1.19 CONSTRUCTION SIGN (CONT)**

- D. Detail Drawing of construction sign showing required legend and other characteristics of sign is attached hereto and made a part of this specification.

**1.20 SAFETY SIGN**

- A. Provide a Safety Sign where directed by Resident Engineer. Face of sign shall be 19 mm (3/4 inch) thick exterior grade plywood. Provide two 100 mm by 100 mm (four by four inch) posts extending full height of sign and 900 mm (three feet) into ground. Set bottom of sign level at 1200 mm (four feet) above ground.
- B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design shall be painted with gloss paint of colors noted.
- C. Maintain sign and remove it when directed by Resident Engineer.
- D. Standard Detail Drawing Number SD10000-02(Found on VA TIL) of safety sign showing required legend and other characteristics of sign is attached hereto and is made a part of this specification.
- E. Post the number of accident free days on a daily basis.

**SECTION 01 00 00**  
**GENERAL REQUIREMENTS**

**1.21 PHOTOGRAPHIC DOCUMENTATION**

- A. During the construction period through completion, provide photographic documentation of construction progress and at selected milestones including electronic indexing, navigation, storage and remote access to the documentation, as per these specifications. The individual used for this work shall be consistent with the quality and format.
- B. Photographic documentation elements:
  - 1. Each digital image shall be taken with a digital camera with minimum size of 6 megapixels (MP) capable of producing 200x250mm (8 x 10 inch) prints with a minimum of 2272 x 1704 pixels and 400x500mm (16 x 20 inch) prints with a minimum 2592 x 1944 pixels.
  - 2. Construction progress for all trades shall be tracked at pre-determined intervals, but not less than once every fourteen (14) calendar days ("Progressions"). Progression documentation shall track both the exterior and interior construction of the building. Exterior Progressions shall track 360 degrees around the site and each building. Interior Progressions shall track interior improvements beginning when stud work commences and continuing until Project completion.
  - 3. As-built condition of pre-slab utilities and site utilities shall be documented prior to pouring slabs, placing concrete and/or backfilling. This process shall include all underground and in-slab utilities within the building(s) envelope(s) and utility runs in the immediate vicinity of the building(s) envelope(s). This may also include utilities enclosed in slab-on-deck in multi-story buildings.
  - 4. As-built conditions of mechanical, electrical, plumbing and all other systems shall be documented post-inspection and pre-insulation, sheet rock or dry wall installation.
  - 5. As-built conditions of exterior skin and elevations shall be documented in order to capture pre-determined focal points, such as waterproofing, window flashing, radiused steel work, architectural detailing.
  - 6. Weekly Site Progressions - Photographic documentation capturing the project at different stages of construction. These progressions shall capture underground utilities, excavation, grading, backfill, landscaping and road construction throughout the duration of the project..
  - 7. Coordinate number of photos and frequency with Resident Engineer,

**1.21 PHOTOGRAPHIC DOCUMENTATION (CONT)**

- C. Contractor shall provide all documentation on-line available to the Construction and Design Team.
- D. Upon completion of the project, final copies of the documentation (the "Permanent Record") shall be provided in an electronic media format, typically a DVD .

**SECTION 01 00 00  
GENERAL REQUIREMENTS**

**1.22 HISTORIC PRESERVATION**

Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the Resident Engineer verbally, and then with a written follow up.

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**SECTION 01 32 16.15  
PROJECT SCHEDULES**

**PART 1- GENERAL**

**1.1 DESCRIPTION:**

- A. The Contractor shall develop a Critical Path Method (CPM) plan and schedule demonstrating fulfillment of the contract requirements (Project Schedule), and shall keep the Project Schedule up-to-date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers).

**1.2 CONTRACTOR'S REPRESENTATIVE:**

- A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Contracting Officer's Representative (COTR).
- B. The Contractor's representative shall have the option of developing the project schedule within their organization or to engage the services of an outside consultant. If an outside scheduling consultant is utilized, Section 1.3 of this specification will apply.

**1.4 COMPUTER PRODUCED SCHEDULES**

- A. The contractor shall provide monthly, all computer-produced time/cost schedules and reports generated from project updates. This monthly computer service will include: three copies of up to five different reports (inclusive of all pages) available within the user defined reports of the scheduling software approved by the Contracting Officer; a hard copy listing of all project schedule changes, and associated data, made at the update and an electronic file of this data; and the resulting monthly updated schedule in PDM format. These must be submitted with and substantively support the contractor's monthly payment request and the signed look ahead report. The COTR shall identify the five different report formats that the contractor shall provide.
- B. The contractor shall be responsible for the correctness and timeliness of the computer-produced reports. The Contractor shall also responsible for the accurate and timely submittal of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.
- C. The VA will report errors in computer-produced reports to the Contractor's representative within ten calendar days from receipt of reports. The Contractor shall reprocess the computer-produced reports and associated diskette to correct errors which affect the payment and schedule for the project.

**1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL**

- A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the interim schedule on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum activity/event ID, activity/event description, duration, budget amount, early start date, early finish date,

SECTION 01 32 16.15  
PROJECT SCHEDULES

**1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL (CONT)**

late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints.

Activity/event date constraints, not required will not be accepted unless approved by the Contracting Officer. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. **The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents.** These changes/delays shall be entered at the first update after Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

- B. The baseline schedule shall constitute the approved baseline schedule until subsequently revised.

**1.6 WORK ACTIVITY/EVENT COST DATA**

- A. The Contractor shall cost load all work activities/events except procurement activities. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.
- B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS).
- C. In accordance with FAR 52.236 - 1 (PERFORMANCE OF WORK BY THE CONTRACTOR) and VAAR 852.236 - 72 (PERFORMANCE OF WORK BY THE CONTRACTOR), the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule a responsibility code for all activities/events of the project for which the Contractor's forces will perform the work.
- D. The Contractor shall cost load work activities/events for all BID ITEMS including ASBESTOS ABATEMENT. The sum of each BID ITEM work shall equal the value of the bid item in the Contractors' bid.

**1.7 PROJECT SCHEDULE REQUIREMENTS**

- A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor Shall:

**SECTION 01 32 16.15  
PROJECT SCHEDULES**

**1.7 PROJECT SCHEDULE REQUIREMENTS (CONT)**

1. Show activities/events as:
  - a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
  - b. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
  - c. Interruption of VA Facilities utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
  - d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
  - e. VA inspection and acceptance activity/event with a minimum duration of five work days
3. Break up the work into activities/events of a duration no longer than 20 work days each or one reporting period, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the COTR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.
4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Lead and lag time activities will not be acceptable.
5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.
- B. The Contractor shall submit the following supporting data in addition to the project schedule:
  1. The appropriate project calendar including working days and holidays.
  2. The planned number of shifts per day.
  3. The number of hours per shift.Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.
- C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the COTR. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the COTR's approval of the Project Schedule.
- D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA an electronic file(s) containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

**1.8 PAYMENT TO THE CONTRACTOR:**

- A. Monthly, the contractor shall submit the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 - 5 and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing

SECTION 01 32 16.15  
PROJECT SCHEDULES

**1.8 PAYMENT TO THE CONTRACTOR: (CONT)**

of all agreed upon project schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.

- B. Approval of the Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

**1.9 PAYMENT AND PROGRESS REPORTING**

- A. Monthly schedule update meetings will be held on dates mutually agreed to by the COTR and the Contractor. Contractor and their CPM consultant (if applicable) shall attend all monthly schedule update meetings. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the COTR three work days in advance of the schedule update meeting. Job progress will be reviewed to verify:
1. Actual start and/or finish dates for updated/completed activities/events.
  2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
  3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
  4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
  5. Completion percentage for all completed and partially completed activities/events.
  6. Logic and duration revisions required by this section of the specifications.
  7. Activity/event duration and percent complete shall be updated independently.
- B. After completion of the joint review, the contractor shall generate an updated computer-produced calendar-dated schedule and supply the Contracting Officer's representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.
- C. After completing the monthly schedule update, the contractor's representative or scheduling consultant shall rerun all current period contract change(s) against the prior approved monthly project schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the contractor and resident engineer for the contract change(s). When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the resident engineer. After each rerun update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.4 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the resident engineer within fourteen (14) calendar days of completing the regular schedule update. **Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.**
- D. Following approval of the CPM schedule, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to



**SECTION 01 32 16.15**  
**PROJECT SCHEDULES**

**1.9 PAYMENT AND PROGRESS REPORTING (CONT)**

identify any necessary actions required to maintain project schedule during the reporting period. The Government representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain project schedule status during the reporting period. This schedule coordination meeting will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the project schedule status, when appropriate.

**1.10 RESPONSIBILITY FOR COMPLETION**

- A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
  - 1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
  - 2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
  - 3. Reschedule the work in conformance with the specification requirements.
- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the COTR for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost to the Government.

**1.11 CHANGES TO THE SCHEDULE**

- A. Within 30 calendar days after VA acceptance and approval of any updated project schedule, the Contractor shall submit a revised electronic file (s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:
  - 1. Delay in completion of any activity/event or group of activities/events, which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.
  - 2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
  - 3. The schedule does not represent the actual prosecution and progress of the project.
  - 4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.
- B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Facility, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, shall be furnished in writing to the Contracting Officer for approval.

**SECTION 01 32 16.15**  
**PROJECT SCHEDULES**

**1.11 CHANGES TO THE SCHEDULE (CONT)**

- C. Contracting Officer's approval for the revised project schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.
- D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental), and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.
- E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

**1.12 ADJUSTMENT OF CONTRACT COMPLETION**

- A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the COTR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.
- B. Actual delays in activities/events which, according to the computer- produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.
- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.
- D. All delays due to non-work activities/events such as RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

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**SECTION 01 33 23**  
**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
  - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
  - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by Resident Engineer on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.
- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.

**SECTION 01 33 23**  
**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

- A. Submit samples required by Section 09 06 00, SCHEDULE FOR FINISHES, in quadruplicate. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
- B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Medical Center name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
  - 1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
  - 2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
  - 3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests (those preceded by symbol "LT" under the separate sections of the specification shall be tested, at the expense of Contractor, in a commercial laboratory approved by Contracting Officer.
  - 1. Laboratory shall furnish Contracting Officer with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
  - 2. Certificates shall also set forth a list of comparable projects upon which laboratory has performed similar functions during past five years.
  - 3. Samples and laboratory tests shall be sent directly to approved commercial testing laboratory.
  - 4. Contractor shall send a copy of transmittal letter to both Resident Engineer and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
  - 5. Laboratory test reports shall be sent directly to Resident Engineer for appropriate action.
  - 6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
  - 7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.

**SECTION 01 33 23**  
**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

- E. Approved samples will be kept on file by the Resident Engineer at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.
- F. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
1. For each drawing required, submit one legible photographic paper or vellum reproducible.
  2. Reproducible shall be full size.
  3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
  4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
  5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
  6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
  7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.
- 1-10 "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."
- 1-11. Samples shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to

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(Architect-Engineer)

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(A/E P.O. Address)

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(City, State and Zip Code)

**SECTION 01 33 23**  
**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

- 1-11. At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the Resident Engineer.
- 1-12. Samples (except laboratory samples) for approval shall be sent to Architect-Engineer, in care of Resident Engineer, VA Medical Center, \_\_\_\_\_  
(P.O. Address)  
\_\_\_\_\_  
(City, State and Zip Code)

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**SECTION 01 42 19  
REFERENCE STANDARDS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

**1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)**

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to – GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

**1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)**

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARTMENT OF VETERANS AFFAIRS  
Office of Construction & Facilities Management  
Facilities Quality Service (00CFM1A)  
425 Eye Street N.W, (sixth floor)  
Washington, DC 20001  
Telephone Numbers: (202) 632-5249 or (202) 632-5178  
Between 9:00 AM - 3:00 PM

**SECTION 01 42 19  
REFERENCE STANDARDS**

**1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF  
FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM  
DESCRIPTIONS (FAR 52.211-3) (JUN 1988)**

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA	Aluminum Association Inc. <a href="http://www.aluminum.org">http://www.aluminum.org</a>
AABC	Associated Air Balance Council <a href="http://www.aabchq.com">http://www.aabchq.com</a>
AAMA	American Architectural Manufacturer's Association <a href="http://www.aamanet.org">http://www.aamanet.org</a>
AAN	American Nursery and Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
AASHTO	American Association of State Highway and Transportation Officials <a href="http://www.aashto.org">http://www.aashto.org</a>
ACGIH	American Conference of Governmental Industrial Hygienists <a href="http://www.acgi.org">http://www.acgi.org</a>
ACI	American Concrete Institute <a href="http://www.aci-int.net">http://www.aci-int.net</a>
ACPA	American Concrete Pipe Association <a href="http://www.concrete-pipe.org">http://www.concrete-pipe.org</a>
ACPPA	American Concrete Pressure Pipe Association <a href="http://www.acppa.org">http://www.acppa.org</a>
ADC	Air Diffusion Council <a href="http://flexibleduct.org">http://flexibleduct.org</a>
AGA	American Gas Association <a href="http://www.aga.org">http://www.aga.org</a>
AGC	Associated General Contractors of America <a href="http://www.agc.org">http://www.agc.org</a>
AGMA	American Gear Manufacturers Association, Inc. <a href="http://www.agma.org">http://www.agma.org</a>
AISC	American Institute of Steel Construction <a href="http://www.aisc.org">http://www.aisc.org</a>



**SECTION 01 42 19**  
**REFERENCE STANDARDS**

AISI	American Iron and Steel Institute <a href="http://www.steel.org">http://www.steel.org</a>
AITC	American Institute of Timber Construction <a href="http://www.aitc-glulam.org">http://www.aitc-glulam.org</a>
AMCA	Air Movement and Control Association, Inc. <a href="http://www.amca.org">http://www.amca.org</a>
ANLA	American Nursery & Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
ANSI	American National Standards Institute, Inc. <a href="http://www.ansi.org">http://www.ansi.org</a>
APA	The Engineered Wood Association <a href="http://www.apawood.org">http://www.apawood.org</a>
ARI	Air-Conditioning and Refrigeration Institute <a href="http://www.ari.org">http://www.ari.org</a>
ASCE	American Society of Civil Engineers <a href="http://www.asce.org">http://www.asce.org</a>
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers <a href="http://www.ashrae.org">http://www.ashrae.org</a>
ASME	American Society of Mechanical Engineers <a href="http://www.asme.org">http://www.asme.org</a>
ASSE	American Society of Sanitary Engineering <a href="http://www.asse-plumbing.org">http://www.asse-plumbing.org</a>
ASTM	American Society for Testing and Materials <a href="http://www.astm.org">http://www.astm.org</a>
AWI	Architectural Woodwork Institute <a href="http://www.awinet.org">http://www.awinet.org</a>
AWS	American Welding Society <a href="http://www.aws.org">http://www.aws.org</a>
AWWA	American Water Works Association <a href="http://www.awwa.org">http://www.awwa.org</a>
BHMA	Builders Hardware Manufacturers Association <a href="http://www.buildershardware.com">http://www.buildershardware.com</a>

**SECTION 01 42 19  
REFERENCE STANDARDS**

BIA	Brick Institute of America <a href="http://www.bia.org">http://www.bia.org</a>
CAGI	Compressed Air and Gas Institute <a href="http://www.cagi.org">http://www.cagi.org</a>
CISCA	Ceilings and Interior Systems Construction Association <a href="http://www.cisca.org">http://www.cisca.org</a>
CISPI	Cast Iron Soil Pipe Institute <a href="http://www.cispi.org">http://www.cispi.org</a>
CLFMI	Chain Link Fence Manufacturers Institute <a href="http://www.chainlinkinfo.org">http://www.chainlinkinfo.org</a>
CPMB	Concrete Plant Manufacturers Bureau <a href="http://www.cpmb.org">http://www.cpmb.org</a>
CRSI	Concrete Reinforcing Steel Institute <a href="http://www.crsi.org">http://www.crsi.org</a>
CTI	Cooling Technology Institute <a href="http://www.cti.org">http://www.cti.org</a>
DHI	Door and Hardware Institute <a href="http://www.dhi.org">http://www.dhi.org</a>
EGSA	Electrical Generating Systems Association <a href="http://www.egsa.org">http://www.egsa.org</a>
EPA	Environmental Protection Agency <a href="http://www.epa.gov">http://www.epa.gov</a>
ETL	ETL Testing Laboratories, Inc. <a href="http://www.etl.com">http://www.etl.com</a>
GANA	Glass Association of North America <a href="http://www.cssinfo.com/info/gana.html/">http://www.cssinfo.com/info/gana.html/</a>
FM	Factory Mutual Insurance <a href="http://www.fmglobal.com">http://www.fmglobal.com</a>
GA	Gypsum Association <a href="http://www.gypsum.org">http://www.gypsum.org</a>
GSA	General Services Administration <a href="http://www.gsa.gov">http://www.gsa.gov</a>
HPVA	Hardwood Plywood & Veneer Association <a href="http://www.hpva.org">http://www.hpva.org</a>

**SECTION 01 42 19**  
**REFERENCE STANDARDS**

ICBO	International Conference of Building Officials <a href="http://www.icbo.org">http://www.icbo.org</a>
ICAC	Institute of Clean Air Companies <a href="http://www.icac.com">http://www.icac.com</a>
IEEE	Institute of Electrical and Electronics Engineers <a href="http://www.ieee.org">http://www.ieee.org</a>
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. <a href="http://www.mss-hq.com">http://www.mss-hq.com</a>
NAAMM	National Association of Architectural Metal Manufacturers <a href="http://www.naamm.org">http://www.naamm.org</a>
NAPHCC	Plumbing-Heating-Cooling Contractors Association <a href="http://www.phccweb.org.org">http://www.phccweb.org.org</a>
NBS	National Bureau of Standards See - NIST
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors <a href="http://www.nationboard.org">http://www.nationboard.org</a>
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association <a href="http://www.nema.org">http://www.nema.org</a>
NFPA	National Fire Protection Association <a href="http://www.nfpa.org">http://www.nfpa.org</a>
NHLA	National Hardwood Lumber Association <a href="http://www.natlhardwood.org">http://www.natlhardwood.org</a>
NIH	National Institute of Health <a href="http://www.nih.gov">http://www.nih.gov</a>
NPA	National Particleboard Association 18928 Premiere Court Gaithersburg, MD 20879 (301) 670-0604
NSF	National Sanitation Foundation <a href="http://www.nsf.org">http://www.nsf.org</a>
NWWDA	Window and Door Manufacturers Association <a href="http://www.nwwda.org">http://www.nwwda.org</a>

**SECTION 01 42 19**  
**REFERENCE STANDARDS**

OSHA	Occupational Safety and Health Administration Department of Labor <a href="http://www.osha.gov">http://www.osha.gov</a>
PCA	Portland Cement Association <a href="http://www.portcement.org">http://www.portcement.org</a>
PCI	Precast Prestressed Concrete Institute <a href="http://www.pci.org">http://www.pci.org</a>
PPIT	The Plastic Pipe Institute <a href="http://www.plasticpipe.org">http://www.plasticpipe.org</a>
PEI	Porcelain Enamel Institute, Inc. <a href="http://www.porcelainenamel.com">http://www.porcelainenamel.com</a>
PTI	Post-Tensioning Institute <a href="http://www.post-tensioning.org">http://www.post-tensioning.org</a>
RFCI	The Resilient Floor Covering Institute <a href="http://www.rfci.com">http://www.rfci.com</a>
RMA	Rubber Manufacturers Association, Inc. <a href="http://www.rma.org">http://www.rma.org</a>
SDI	Steel Door Institute <a href="http://www.steeldoor.org">http://www.steeldoor.org</a>
IGMA	Insulating Glass Manufacturers Alliance <a href="http://www.igmaonline.org">http://www.igmaonline.org</a>
SJI	Steel Joist Institute <a href="http://www.steeljoist.org">http://www.steeljoist.org</a>
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. <a href="http://www.smacna.org">http://www.smacna.org</a>
SSPC	The Society for Protective Coatings <a href="http://www.sspc.org">http://www.sspc.org</a>
SWI	Steel Window Institute <a href="http://www.steelwindows.com">http://www.steelwindows.com</a>
TCA	Tile Council of America, Inc. <a href="http://www.tileusa.com">http://www.tileusa.com</a>
TEMA	Tubular Exchange Manufacturers Association <a href="http://www.tema.org">http://www.tema.org</a>

**SECTION 01 42 19  
REFERENCE STANDARDS**

TPITruss Plate Institute, Inc.  
583 D'Onofrio Drive; Suite 200  
Madison, WI 53719  
(608) 833-5900

UBC      The Uniform Building Code  
            See ICBO

UL        Underwriters' Laboratories Incorporated  
            <http://www.ul.com>

ULC       Underwriters' Laboratories of Canada  
            <http://www.ulc.ca>

WCLIB    West Coast Lumber Inspection Bureau  
            6980 SW Varns Road, P.O. Box 23145  
            Portland, OR 97223  
            (503) 639-0651

WWPA    Western Wood Products Association  
            <http://www.wwpa.org>

- - - E N D - - -



**SECTION 01 45 29**  
**TESTING LABORATORY SERVICES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by Contractor.

**1.2 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
  - T27-06.....Sieve Analysis of Fine and Coarse Aggregates
  - T96-02 (R2006) .....Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  - T99-01 (R2004) .....The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
  - T180-01 (R2004) .....Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
  - T191-02(R2006) .....Density of Soil In-Place by the Sand-Cone Method
- C. American Society for Testing and Materials (ASTM):
  - A325-06.....Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
  - A370-07.....Definitions for Mechanical Testing of Steel Products
  - A416/ A416M-06.....Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
  - C31/ C31M-06 .....Making and Curing Concrete Test Specimens in the Field
  - C33-03 .....Concrete Aggregates
  - C39/ C39M-05 .....Compressive Strength of Cylindrical Concrete Specimens
  - C138-07 .....Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
  - C172-07 .....Sampling Freshly Mixed Concrete
  - C173-07 .....Air Content of freshly Mixed Concrete by the Volumetric Method
  - C330-05 .....Lightweight Aggregates for Structural Concrete
  - C780-07 .....Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
  - C1019-08.....Sampling and Testing Grout
  - C1064/ C1064M-05 .....Freshly Mixed Portland Cement Concrete
  - C1077-06 .....Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
  - D698-07.....Laboratory Compaction Characteristics of Soil Using Standard Effort
  - D1556-07.....Density and Unit Weight of Soil in Place by the Sand-Cone Method
  - D1557-07.....Laboratory Compaction Characteristics of Soil Using Modified Effort
  - D2216-05.....Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
  - D2922-05.....Density of soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

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**TESTING LABORATORY SERVICES**

- D3666-(2002) ..... Minimum Requirements for Agencies Testing and  
Inspection Bituminous Paving Materials
- D3740-07 ..... Minimum Requirements for Agencies Engaged in the  
Testing and Inspecting Road and Paving Material
- E329-07 ..... Agencies Engaged in Construction Inspection and/or Testing
- E543-06 ..... Agencies Performing Non-Destructive Testing
- D. American Welding Society (AWS):
- D1.1-07 ..... Structural Welding Code-Steel

**1.3 REQUIREMENTS:**

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E 329, C 1077, D 3666, D3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Resident Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Resident Engineer to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to Resident Engineer, Contractor, unless other arrangements are agreed to in writing by the Resident Engineer. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to Resident Engineer immediately of any irregularity.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 EARTHWORK:**

- A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the Resident Engineer regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Resident Engineer extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.



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**TESTING LABORATORY SERVICES**

**3.1 EARTHWORK: (CONT)**

2. Provide observation of fill placement and compaction and field density testing in building areas and provide observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
- B. Testing Compaction:
1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D1557.
    - a. Building Slab Subgrade: At least one test of subgrade for every 185 m<sup>2</sup> (2000 square feet) of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 185 m<sup>2</sup> (2000 square feet) of overlaying building slab, but in no case fewer than three tests.
    - c. Pavement Subgrade: One test for each 335 m<sup>2</sup> (400 square yards), but in no case fewer than two tests.
    - d. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.
    - e. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.

**3.2 ASPHALT CONCRETE PAVING:**

- A. Aggregate Base Course:
1. Determine maximum density and optimum moisture content for aggregate base material in accordance with ASTM D1557, Method D
  2. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.
  2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with ASTM D1556 .
- B. Asphalt Concrete:
1. Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
  2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
  3. Density: Make a minimum of two field density tests in accordance with ASTM D1188 of asphalt base and surface course for each day's paving operation.

**3.3 SITE WORK CONCRETE:**

Test site work concrete including materials for concrete as required in Article CONCRETE of this section.

**3.4 CONCRETE:**

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**TESTING LABORATORY SERVICES**

**A. Field Inspection and Materials Testing:**

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m<sup>3</sup> (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. Resident Engineer may require additional cylinders to be molded and cured under job conditions.
3. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
4. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m<sup>3</sup> (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m<sup>3</sup> (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
5. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
6. Verify that specified mixing has been accomplished.
7. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement.
8. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
9. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
11. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
12. Observe concrete mixing:
  - a. Monitor and record amount of water added at project site.
  - b. Observe minimum and maximum mixing times.
13. Other inspections:
  - a. Grouting under base plates.
  - b. Grouting anchor bolts and reinforcing steel in hardened concrete.

**B. Laboratory Tests of Field Samples:**

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by Resident Engineer. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
2. Furnish certified compression test reports (duplicate) to Resident Engineer. In test report, indicate the following information:
  - a. Cylinder identification number and date cast.
  - b. Specific location at which test samples were taken.

**3.4 CONCRETE: (CONT)**

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**TESTING LABORATORY SERVICES**

- c. Type of concrete, slump, and percent air.
- d. Compressive strength of concrete in MPa (psi).
- e. Weather conditions during placing.
- f. Maximum and minimum ambient temperature during placing.
- g. Ambient temperature when concrete sample in test cylinder was taken.
- h. Date delivered to laboratory and date tested.

**3.5 MASONRY:**

- A. Mortar Tests:
  - 1. Laboratory compressive strength test:
    - a. Comply with ASTM C780.
    - b. Obtain samples during or immediately after discharge from batch mixer.
    - c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.
    - d. Test one sample at 7 days and 2 samples at 28 days.
  - 2. Two tests during first week of operation; one test per week after initial test until masonry completion.
- B. Grout Tests:
  - 1. Laboratory compressive strength test:
    - a. Comply with ASTM C1019.
    - b. Test one sample at 7 days and 2 samples at 28 days.

**3.6 STRUCTURAL STEEL:**

- A. General: Provide field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.
- B. Fabrication and Erection:
  - 1. Weld Inspection:
    - a. Inspect welding equipment for capacity, maintenance and working condition.
    - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
    - d. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
    - e. Verify that correction of rejected welds are made in accordance with AWS D1.1.
    - f. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
  - 2. Bolt Inspection:
    - a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
    - b. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.

**3.6 STRUCTURAL STEEL: (Cont)**

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**TESTING LABORATORY SERVICES**

- c. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
- C. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to Resident Engineer.

**3.7 STEEL DECKING:**

- A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer's requirements.
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS D1.1. Refer to the "Plug Weld Qualification Procedure" in Part 3 "Field Quality Control."
- C. Submit inspection reports, certification, and instances of noncompliance to Resident Engineer.

**3.8 TECHNICAL PERSONNEL**

- A. Technicians to perform tests and inspection listed above. Laboratory will be equipped with concrete cylinder storage facilities, compression machine, cube molds, proctor molds, balances, scales, moisture ovens, slump cones, air meter, and all necessary equipment for compaction control.

- - - E N D - - -

SECTION 01 56 39  
TEMPORARY TREE AND PLANT PROTECTION

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Protection of existing trees from damage.
- B. Temporary fencing, barricades, and guards to protect trees which are to remain from damage above and below grade.
  - 1. Erect as directed by Architect and Owner.
- C. Protection of root systems from smothering and compaction.
  - 1. Do not store construction materials or permit vehicles to drive or park within Zone of Protection of any tree to remain.
- D. Protection of plant growth, including root systems of trees, from dumping of refuse or chemically injurious material or liquids, and continual puddling of running water.
- E. Specification shall be applied concurrently and in conjunction with other plant material protection measures herein described and specified.

**1.2 RELATED SECTIONS**

- A. Section 32 80 00 Irrigation.
- B. Section 32 93 00 Plants.

**1.3 DEFINITIONS**

- A. Designated Trees: As indicated on Drawings.
- B. Critical Root Zone (CRZ): The CRZ for trees 4 inches in caliper or smaller shall be an area with a radius at least 5 feet from the trunk. The CRZ for trees over 4 inches in caliper shall be an area with a radius of at least 1 foot 6 inches from the trunk for every 1 inch of caliper size, measured 4' up the trunk of the tree from the ground.
- C. Zone of Protection: As indicated on Drawings.

**1.4 NOTICE**

- A. Notify all workers, including subcontractors, of the requirements to protect Designated Trees using Notice provided.

SECTION 01 56 39  
TEMPORARY TREE AND PLANT PROTECTION

**1.5 PROTECTIVE FENCING**

- A. Install protective fencing around Designated Trees, where shown on Drawings, prior to commencement of any work. Fencing to be a minimum 6 foot chain link, with fence posts securely anchored. Maintain during construction. Adjustments to fence locations are to be approved by the Landscape Architect prior to performing any work within the Zone of Protection.
- B. Protective fencing: Fencing shall remain in place after project completion and shall become the property of the Owner.

**1.6 TRENCHING AND EXCAVATION**

- A. All trenching and excavation within the Zone of Protection is to be performed with the use of an air spade or by hand. Obtain Owner's Representative approval of trenching and excavation locations and methods prior to performing any work.

**1.8 ROOT PRUNING**

- A. Prune roots encountered during construction with an approved root-pruning device. Make clean, vertical cuts. Do not leave split or frayed ends. Obtain Owner's Representative approval prior to cutting roots larger than 1 1/2 inches in diameter. Backfill exposed roots with specified Topsoil as soon as practical.

**1.9 TREE CANOPY PRUNING**

- A. Prune canopies of Designated Trees impacted by construction only upon approval of Owner's Representative. All canopy pruning must be performed by a certified arborist.

**1.10 MULCH**

- A. Provide four (4) inch deep mulch within as directed.

**1.11 WATERING**

- A. Water trees if required by Owner's Representative. Watering will be required if it is judged that root removal is necessary for construction and threatens the survival of the tree. Use a slow drip or soaker hose to provide one-inch water per week until completion of construction.

SECTION 01 56 39  
TEMPORARY TREE AND PLANT PROTECTION

**1.12 PROHIBITED ACTIVITIES**

- A. Cutting of roots larger than 1 1/2 inch diameter or larger without approval.
- B. Damaging tree bark, branches.
- C. Removal of protective fencing or notice posted on trees prior to approval of Owner's Representative.
- D. Activities prohibited within the Zone of Protection (without prior approval) are, but not limited to: construction, operation of machinery, storage of materials, paving, grading, cutting, filling, travel within, dumping, disposal of liquids, and parking of vehicles or equipment.

**1.13 DAMAGE**

- A. Actual tree damage such as trunk scoring and broken limbs or damaged roots inside the Zone of Protection will be assessed according to the percentage of loss of tree value. Percentage of tree value will be determined by the Owner's Representative. Tree value will be determined from "Evaluation of Landscape Trees, Shrubs, and Other Landscape Plants" by International Society of Arboriculture.

**PART 2 - PRODUCTS**

**2.1 FENCING**

- A. Protective Fence: 6-ft chain link with 6-ft metal "T" stakes

**PART 3 - EXECUTION**

**3.1 INSPECTION**

- A. Inspect trees shown on plans to be protected, prior to start of construction.
  - 1. Document and photograph unusual conditions.
  - 2. Submit copies of documentation to Owner's Representative prior to beginning work.
  - 3. Verify conditions regarding tree protection prior to site disturbance.
- B. Owner's Representative must be present during demolition of existing conditions within dripline of trees to remain.
- C. Notify Owner's Representative 24 hours prior to inspection and / or tagging of protected trees.

SECTION 01 56 39  
TEMPORARY TREE AND PLANT PROTECTION

**3.2 GENERAL**

- A. Install Protective Fencing around Designated Trees, where shown on Drawings, prior to commencement of any work. Anchor fence posts securely. Maintain fencing throughout construction. Adjustments to fence locations are to be approved by the Owner's Representative prior to performing any work within the Zone of Protection.
  - 1. Designate protected trees to be clear of any material storage, personnel, or vehicular movement.
- B. Protect root systems of trees to remain from damage due to noxious materials in solution caused by runoff or spillage during mixing and placement of construction materials.
- C. Protect root systems of trees to remain from flooding, erosion, or excessive wetting resulting from dewatering operations and compaction.
- D. Protect existing trees to remain against unauthorized cutting, breaking, or skinning roots and branches, skinning, and bruising of bark.
- E. Fires on project site are not allowed.
- F. Where cutting seems necessary, review conditions with Architect before proceeding, and comply with directives.
- G. Protective fencing: Fencing shall remain in place after project completion and shall become the property of the Owner.

**3.3 EXCAVATION AROUND TREES**

- A. Excavate within Zone of Protection of trees only as approved by Owner's Representative.
- B. All trenching and excavation within the Zone of Protection is to be performed with the use of an air spade or by hand. Obtain Owner's Representative approval of trenching and excavation locations and methods prior to performing any work.

Where trenching for utilities is required within drip lines, tunnel under or around roots by hand digging or boring.

  - 1. Do not cut main lateral roots or tap roots over one inch diameter.
  - 2. Trench toward trunk of tree and tunnel under central root mass to avoid severing lateral roots on side of trench.
  - 3. Temporarily support and protect from damage until permanently covered with approved backfill.
- C. Do not allow exposed roots to dry out before permanent backfill is placed. Provide temporary earth or burlap cover.
  - 1. Water roots daily when exposed and maintain in a moist condition.



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TEMPORARY TREE AND PLANT PROTECTION

- D. Backfill roots after inspection approval from Owner's Representative.
  - 1. Backfill around root excavations only with clean import topsoil free from materials deleterious to root growth.
  - 2. Backfill to eliminate voids, compact only by means of manual tamping at root areas.
  - 3. Water sufficient to settle topsoil and eliminate voids or air pockets around roots.
  - 4. Allow for natural settlement of soil surface, and furnish and apply topsoil sufficient to bring to original finish grade after backfill settlement.
- E. Conditions that threaten survivability of protected tree or that affects stability or integrity of root system, notify Owner's Representative.

**3.4 ROOT PRUNING**

- A. Prune roots encountered during construction with an approved root-pruning device. Make clean, vertical cuts. Do not leave split or frayed ends. Obtain Owner's Representative approval prior to cutting roots larger than 1 1/2 inches in diameter. Backfill exposed roots with specified Topsoil as soon as practical.

**3.5 GRADING AND FILLING AROUND TREES**

- A. Maintain existing grade within Zone of Protection of trees unless otherwise indicated on Drawings.

**3.6 TREE CANOPY PRUNING**

- A. Prune canopies of Designated Trees impacted by construction only upon approval of Owner's Representative. All canopy pruning must be performed by a certified arborist.

**3.7 MULCH**

- A. Provide four (4) inch deep mulch within as directed.

**3.8 WATERING**

- A. Water trees if required by Owner's Representative. Watering will be required if it is judged that root removal is necessary for construction and threatens the survival of the tree. Use a slow drip or soaker hose to provide one-inch water per week until completion of construction.

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TEMPORARY TREE AND PLANT PROTECTION

**3.9 PROHIBITED ACTIVITIES**

- A. Cutting of roots larger than 1 1/2 inch diameter or larger without approval.
- B. Damaging tree bark, branches.
- C. Removal of protective fencing or notice posted on trees prior to approval of Owner's Representative.
- D. Activities prohibited within the Zone of Protection (without prior approval) are, but not limited to: construction, operation of machinery, storage of materials, paving, grading, cutting, filling, travel within, dumping, disposal of liquids, and parking of vehicles or equipment

**3.10 PROTECTION**

- A. Maintain protective measures throughout construction process.
  - 1. Repair any alteration to protection measures throughout construction process.
  - 2. Repair or reinstall protective measures upon alteration.
  - 3. Monitor protective measures daily.

**3.11 REPAIR**

- A. Immediately repair damage to existing trees and shrubs.
  - 1. Repair by trimming, cleaning and painting damaged areas, including roots, in accordance with current volume of American National Standard for Tree Care Operations -- Tree, Shrub and Other Woody Plant Maintenance.
  - 2. Pruning and/or repairs must be approved in advance and at completion.
  - 3. Contractor responsible for cost of repair caused by his actions or by actions of his/her subcontractors.

**3.12 ADDITIONAL TREE REMOVAL**

- A. Advance Approval may be obtained from Resident Engineer or Owner's Representative to remove trees and shrubs not indicated for removal on the plans if they are:
  - 1. Within 15 feet of new construction.
  - 2. Within 7.5 feet of utility lines.

END OF SECTION 01 56 39

**SECTION 01 57 19**  
**TEMPORARY ENVIRONMENTAL CONTROLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
  - 1. Adversely effect human health or welfare,
  - 2. Unfavorably alter ecological balances of importance to human life,
  - 3. Effect other species of importance to humankind, or;
  - 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
  - 1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
  - 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
  - 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
  - 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
  - 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
  - 6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.
  - 7. Sanitary Wastes:
    - a. Sewage: Domestic sanitary sewage and human and animal waste.
    - b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

**1.2 QUALITY CONTROL**

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.
- C. Coordinate with Civil Drawings regarding Erosion Control Measures

**1.3 SUBMITTALS**

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
  - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Resident Engineer to

**SECTION 01 57 19**  
**TEMPORARY ENVIRONMENTAL CONTROLS**

**1.3 SUBMITTALS (CONT)**

discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the Resident Engineer for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:

- a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
  - b. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, , soil, historical, and archeological and cultural resources.
  - c. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
  - d. Permits, licenses, and the location of the solid waste disposal area.
  - e. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

**1.4 PROTECTION OF ENVIRONMENTAL RESOURCES**

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the Resident Engineer. Do not fasten or attach ropes, cables, or guys to trees for anchorage.
1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
  2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
    - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
    - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.

**SECTION 01 57 19**  
**TEMPORARY ENVIRONMENTAL CONTROLS**

**1.4 PROTECTION OF ENVIRONMENTAL RESOURCES (CONT)**

- c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
  3. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
    - a. Reuse or conserve the collected topsoil sediment as directed by the Resident Engineer. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.
    - b. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
  4. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
  5. Manage and control spoil areas on Government property to limit spoil to areas and prevent erosion of soil or sediment from entering nearby water courses or lakes.
  6. Protect adjacent areas from despoilment by temporary excavations and embankments.
  7. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
  8. Handle discarded materials other than those included in the solid waste category as directed by the Resident Engineer.
- C. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of Oregon and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
  1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
  2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
  3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.

**SECTION 01 57 19**  
**TEMPORARY ENVIRONMENTAL CONTROLS**

**1.4 PROTECTION OF ENVIRONMENTAL RESOURCES (CONT)**

4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- D. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the Resident Engineer. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00p.m unless otherwise permitted by local ordinance or the Resident Engineer. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
- a. Maintain maximum permissible construction equipment noise levels at 15 m (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	0
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

- b. Use efficient silencers on equipment air intakes.

**SECTION 01 57 19**  
**TEMPORARY ENVIRONMENTAL CONTROLS**

**1.4 PROTECTION OF ENVIRONMENTAL RESOURCES (CONT)**

- c. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
  - d. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
- E. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- F. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the Resident Engineer. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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**SECTION 01 58 16**  
**TEMPORARY INTERIOR SIGNAGE**

**PART 1 GENERAL**

**DESCRIPTION**

This section specifies temporary interior signs.

**PART 2 PRODUCTS**

**2.1 TEMPORARY SIGNS**

- A. Fabricate from 50 Kg (110 pound) mat finish white paper.
- B. Cut to 100 mm (4-inch) wide by 300 mm (12 inch) long size tag.
- C. Punch 3 mm (1/8-inch) diameter hole centered on 100 mm (4-inch) dimension of tag.  
Edge of Hole spaced approximately 13 mm (1/2-inch) from one end on tag.
- D. Reinforce hole on both sides with gummed cloth washer or other suitable material capable of preventing tie pulling through paper edge.
- E. Ties: Steel wire 0.3 mm (0.0120-inch) thick, attach to tag with twist tie, leaving 150 mm (6-inch) long free ends.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Install temporary signs attached to room door frame or room door knob, lever, or pull for doors on corridor openings.
- B. Mark on signs with felt tip marker having approximately 3 mm (1/8-inch) wide stroke for clearly legible numbers or letters.
- C. Identify room with numbers as designated on floor plans.

**3.2 LOCATION**

- A. Install on doors that have room, corridor, and space numbers shown.
- B. Doors that do not require signs are as follows:
  - 1. Corridor barrier doors (cross-corridor) in corridor with same number.
  - 2. Folding doors or partitions.
  - 3. Toilet or bathroom doors within and between rooms.
  - 4. Communicating doors in partitions between rooms with corridor entrance doors.
  - 5. Closet doors within rooms.
- C. Replace missing, damaged, or illegible signs.

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**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
  - 1. Waste Management Plan development and implementation.
  - 2. Techniques to minimize waste generation.
  - 3. Sorting and separating of waste materials.
  - 4. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
  - 1. Soil.
  - 2. Inerts (eg, concrete, masonry and asphalt).
  - 3. Clean dimensional wood and palette wood.
  - 4. Green waste (biodegradable landscaping materials).
  - 5. Engineered wood products (plywood, particle board and I-joists, etc).
  - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
  - 7. Cardboard, paper and packaging.
  - 8. Bitumen roofing materials.
  - 9. Plastics (eg, ABS, PVC).
  - 10. Carpet and/or pad.
  - 11. Gypsum board.
  - 12. Insulation.
  - 13. Paint.
  - 14. Fluorescent lamps.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.

**1.3 QUALITY ASSURANCE**

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
  - 1. Excess or unusable construction materials.
  - 2. Packaging used for construction products.
  - 3. Poor planning and/or layout.
  - 4. Construction error.
  - 5. Over ordering.
  - 6. Weather damage.
  - 7. Contamination.
  - 8. Mishandling.

**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**1.3 QUALITY ASSURANCE (CONT)**

- 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by construction.
- C. Contractor shall develop and implement procedures to reuse and recycle new materials to a minimum of 50 percent.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

**1.4 TERMINOLOGY**

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**1.4 TERMINOLOGY (CONT)**

- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
  - 1. On-site Recycling – Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
  - 2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

**1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the Resident Engineer a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
  - 1. Procedures to be used for debris management.
  - 2. Techniques to be used to minimize waste generation.
  - 3. Analysis of the estimated job site waste to be generated:
    - a. List of each material and quantity to be salvaged, reused, recycled.
    - b. List of each material and quantity proposed to be taken to a landfill.
  - 4. Detailed description of the Means/Methods to be used for material handling.
    - a. On site: Material separation, storage, protection where applicable.
    - b. Off site: Transportation means and destination. Include list of materials.
      - 1) Description of materials to be site-separated and self-hauled to designated facilities.
      - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.

**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**1.5 SUBMITTALS (CONT)**

- c. The names and locations of mixed debris reuse and recycling facilities or sites.
  - d. The names and locations of trash disposal landfill facilities or sites.
  - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

**1.6 RECORDS**

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. List of each material and quantity to be salvaged, recycled, reused.
- B. List of each material and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

**PART 3 - EXECUTION**

**3.1 COLLECTION**

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

**3.2 DISPOSAL**

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
- B. Construction materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

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## SECTION 01 91 00

### GENERAL COMMISSIONING REQUIREMENTS

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 7, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.
- C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.
- D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 7, Division 8, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.
- E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA's operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction, and post-occupancy phases is intended to achieve the following specific objectives according to the contract documents:
  - 1. Verify that the applicable equipment and systems are installed in accordance with the contract documents and according to the manufacturer's recommendations.
  - 2. Verify and document proper integrated performance of equipment and systems.
  - 3. Verify that Operations & Maintenance documentation is complete.

## SECTION 01 91 00

### GENERAL COMMISSIONING REQUIREMENTS

4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
  5. Verify that the VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
  6. Document the successful achievement of the commissioning objectives listed above.
- F. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.
- G. The Commissioning Agent, both the firm and individual designated as the Commissioning Agent, shall be certified by at least one of the following entities: the National Environmental Balancing Bureau (NEBB), the Associated Air Balance Council Commissioning Group (AABC), and the Building Commissioning Association (BCA). Certification(s) shall be valid and active. Proof of certification(s) shall be submitted to the Contracting Officer and the Resident Engineer three (3) calendar days after the Notice to Proceed.

### 1.2 CONTRACTUAL RELATIONSHIPS

- A. For this construction project, the Department of Veterans Affairs contracts with a Contractor to provide construction services. The contracts are administered by the VA Contracting Officer and the Resident Engineer as the designated representative of the Contracting Officer. On this project, the authority to modify the contract in any way is strictly limited to the authority of the Contracting Officer and the Resident Engineer.
- B. In this structure, only two contract parties are recognized and communications on contractual issues are strictly limited to VA Resident Engineer and the Contractor. It is the practice of the VA to require that communications between other parties to the contracts (Subcontractors and Vendors) be conducted through the Resident Engineer and Contractor. It is also the practice of the VA that communications between other parties of the project (Commissioning Agent and Architect/Engineer) be conducted through the Resident Engineer.
- C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to the construction process. By its nature, a high level of communication and cooperation between the Commissioning Agent and all other parties (Architects, Engineers, Subcontractors, Vendors, third party testing agencies, etc) is essential to the success of the Commissioning effort.
- D. With these fundamental practices in mind, the commissioning process described herein has been developed to recognize that, in the execution of the Commissioning Process, the Commissioning Agent must develop effective methods to communicate with every member of the construction



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team involved in delivering commissioned systems while simultaneously respecting the exclusive contract authority of the Contracting Officer and Resident Engineer. Thus, the procedures outlined in this specification must be executed within the following limitations:

1. No communications (verbal or written) from the Commissioning Agent shall be deemed to constitute direction that modifies the terms of any contract between the Department of Veterans Affairs and the Contractor.
2. Commissioning Issues identified by the Commissioning Agent will be delivered to the Resident Engineer and copied to the designated Commissioning Representatives for the Contractor and subcontractors on the Commissioning Team for information only in order to expedite the communication process. These issues must be understood as the professional opinion of the Commissioning Agent and as suggestions for resolution.
3. In the event that any Commissioning Issues and suggested resolutions are deemed by the Resident Engineer to require either an official interpretation of the construction documents or require a modification of the contract documents, the Contracting Officer or Resident Engineer will issue an official directive to this effect.
4. All parties to the Commissioning Process shall be individually responsible for alerting the Resident Engineer of any issues that they deem to constitute a potential contract change prior to acting on these issues.
5. Authority for resolution or modification of design and construction issues rests solely with the Contracting Officer or Resident Engineer, with appropriate technical guidance from the Architect/Engineer and/or Commissioning Agent.

#### 1.3 RELATED WORK

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 07 08 00 FACILITY EXTERIOR CLOSURE COMMISSIONING.
- C. Section 21 08 00 COMMISSIONING OF FIRE PROTECTION SYSTEMS.
- D. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.
- E. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.
- F. Section 26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS.
- G. Section 27 08 00 COMMISSIONING OF COMMUNICATIONS SYSTEMS.
- H. Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.
- I. Section 31 08 00 COMMISSIONING OF UTILITIES.

#### 1.4 SUMMARY

- A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.

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- B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.

SPEC WRITER NOTE: Paragraph C is for LEED projects. Paragraphs D is for Green Globes Projects. Retain either Paragraph C or Paragraph D as appropriate. Delete paragraph C and paragraph D or subparagraphs if neither applies.

- C. The commissioning activities have been developed to support the United States Green Building Council (USGBC) LEED™ rating program and to support delivery of project performance in accordance with the VA requirements developed for the project.
1. Commissioning activities and documentation for the LEED™ section on “Energy and Atmosphere” and the prerequisite of “Fundamental Building Systems Commissioning.”
  2. Commissioning activities and documentation for the LEED™ section on “Energy and Atmosphere” requirements for the “Enhanced Building System Commissioning” credit.
  3. Activities and documentation for the LEED™ section on “Measurement and Verification” requirements for the Measurement and Verification credit.
- D. The commissioning activities have been developed to support the Green Buildings Initiative Green Globes rating program and to support delivery of project performance in accordance with the VA requirements developed for the project.

### 1.5 DEFINITIONS

- A. Architect: Includes Architect identified in the Contract for Construction between the Department of Veterans Affairs and Contractor, plus consultant/design professionals responsible for design of fire suppression, plumbing, HVAC, controls for HVAC systems, electrical, communications, electronic safety and security, as well as other related systems.
- B. CxA: Commissioning Agent.
- C. Commissioning Plan: a document that is an overall plan that outlines the commissioning process, commissioning team responsibilities, schedule for commissioning activities, and commissioning documents.
- D. Commissioning Issue: a condition in the installation or function of a component, piece of equipment or system that affects the system operations, maintenance, and/or repair.
- E. Commissioning Observation: a condition in the installation or function of a component, piece of equipment or system that may not be in compliance with the Contract Documents, or may not be in compliance with the manufacturer’s installation instruction, or may not be in compliance with generally accepted industry standards.
- F. Systems Functional Performance Test: a test, or tests, of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Systems

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Functional Performance Testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not Systems Functional Performance Testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while System Functional Performance Testing is verifying that the system has already been set up properly and is functioning in accordance with the Construction Documents. The Commissioning Agent develops the Systems Functional Performance Test Procedures in a sequential written form, coordinates, witnesses, and documents the actual testing. Systems Functional Performance Testing is performed by the Contractor. Systems Functional Performance Tests are performed after startups, control systems are complete and operational, TAB functions and Pre-Functional Checklists are complete.

- G. System: A system is defined as the entire set of components, equipment, and subsystems which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one component of an entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam supply, chilled water supply, refrigerant supply, hot water supply, controls and electrical service, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of the fuel supply, combustion air, controls, steam, feedwater supply, condensate return and other related components.
- H. Pre-Functional Checklist: a list of items provided by the Commissioning Agent to the Contractor that require inspection and elementary component tests conducted to verify proper installation of equipment. Pre-Functional Checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some Pre-Functional Checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The term "Pre-Functional" refers to before Systems Functional Performance Testing. Pre-Functional Checklists augment and

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are combined with the manufacturer's startup checklist and the Contractor's Quality Control checklists.

- I. Seasonal Functional Performance Testing: a test or tests that are deferred until the system will experience conditions closer to their design conditions.
- J. VA: Includes the Contracting Officer, Resident Engineer, or other authorized representative of the Department of Veterans Affairs.
- K. TAB: Testing, Adjusting, and Balancing.

#### 1.6 SYSTEMS TO BE COMMISSIONED

- A. Commissioning of a system or systems specified for this project is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.

SPEC WRITER NOTE: Paragraph B should list the specific systems that will be commissioned. Edit the list as necessary for specific projects. The list below should match the list included in Sections XX 08 00 COMMISSIONING OF "XX" SYSTEMS included in the various Divisions' Technical Specifications. It is recommended that the list included in Sections XX 08 00 be developed first and then copied/pasted into the list below. Both lists should be identical to prevent confusion.

- B. The following systems will be commissioned as part of this project:
  - 1. Facility exterior closure (Division 7 and Division 8)
    - a. Roofs (Asphalt shingles, slate shingles, wood shingles, clay roof tiles, built-up bituminous, modified bituminous, EPDM, PVC, fluid-applied, sprayed polyurethane, flashing & sheet metal, metal roofing, roof specialties, and roof accessories)
    - b. Exterior Insulation and Finish Systems (EIFS)
    - c. Curtain Wall Systems (Mullions, glazing, and sealing)
    - d. Exterior Doors (Revolving, glass leaf, emergency exit, and service)
    - e. Exterior Windows (Aluminum, steel, glazing, storm)
    - f. Louvers and Vents
    - g. Sealants (Caulking, mechanical seals, and wind and vapor barriers)
  - 2. Fire Suppression (Division 21)
    - a. Fire Protection System (Fire pump, jockey pump, fire pump automatic transfer switch/controller, Wet-pipe fire suppression, Dry-pipe fire suppression, Pre-action fire suppression, dry system air compressors and motors, and clean agent fire suppression).

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3. Plumbing (Division 22)
  - a. Domestic Hot Water systems (Domestic water heaters, steam-to-hot water converters, hot water circulating pumps and motors, controls, combustion burners/fans/ motors).
  - b. Medical Gas systems (Medical compressed air and air compressor, laboratory vacuum and vacuum pumps, nitrous oxide and oxygen, Medical Gas Alarm System).
  - c. Domestic Water Booster Pumps (Controls, piping, compression tanks, pumps, motors, and Variable Speed Drives).
  - d. Sewage Ejection Pumps (Sump level controls, pump alternator, alarms and alarm panel, pumps and motors).
  - e. Storm Sump Pumps (Sump level controls, pump alternator, alarms and alarm panel, pumps and motors).
  - f. Domestic Water Filtration and Softener Systems (Tanks and casings, gages and instruments, controls, pumps and motors – if applicable, packaged piping, alarms).
  - g. Chemical Waste System & Equipment (Waste storage tanks or sumps, controls and alarms, pumps and motors – if applicable).
  - h. Process Water Systems (Controls, piping, tanks and casings, gages and instruments, pumps, motors, and Variable Speed Drives – if applicable for reverse osmosis (RO) and deionized water (DI) systems).
  - i. Emergency Plumbing Fixtures (Showers, eye wash stations, water tempering valves, instruments and gages).
4. HVAC (Division 23)
  - a. Air Handling Systems (Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties such as smoke detectors or freezestats and damper end switches, controls, gages, and vibration isolation).
  - b. Dehumidification Systems (Energy recovery devices – such as enthalpy wheels, fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties, controls, gages, and vibration isolation).
  - c. Heating Hot Water Systems (Boilers, controls, instrumentation and gages, flues, heating water pumps and motors, Variable Speed Drives, mixing valves).
  - d. Condensate Return Systems (Condensate receivers and transfer pumps, motors, controls, pump alternator, alarms and instrumentation, deaerators, boiler feed pumps and motors, safeties).

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- e. Chilled Water Systems (Chilled water pumps and motors, Variable Speed Drives, chiller motor/compressor, controls, instrumentation and safeties, isolation valves, blending valves, side stream water cleaners/scrubbers/filters).
- f. Condenser Water Systems for Chillers (Condenser water pumps and motors, Variable Speed Drives, cooling tower fans, cooling tower sump level controls, open-circuit water treatment system, water treatment injection pumps and motors, water treatment controls, cooling tower basin heaters and controls, side stream water cleaners/scrubbers/filters, tower bypass valves).
- g. Exhaust Fans (Fan, motor, Variable Speed Drives, controls and safeties).
- h. Steam System (Boilers, controls, gages and instrumentation, safety relief valves, combustion burners/fans/motors, fuel delivery pumps and motors, flues).
- i. Direct Digital Control System (BACnet or similar Local Area Network (LAN), Operator Work Station hardware and software, building controller hardware and software, terminal unit controller hardware and software, all sequences of operation, system accuracy and response time).
- j. Laboratory Exhaust Systems (Fume hoods, pressure controls, system alarms, fans, motors, and Variable Speed Drives).
- k. Laboratory Ventilation Systems (Supply air terminal units and controls, pressure controls and alarms, fans, motors, and Variable Speed Drives).
- l. OR Air Handling Systems (Fans, motors, Variable Speed Drives, Energy recovery devices – such as heat pipes, cooling coils and control valves, heating coils and control valves, filters, HEPA filter performance, dampers, safeties such as smoke detectors or freezestats and damper end switches, controls, gages, and vibration isolation).
- m. Radiology/Imaging Cooling Systems (Fans, motors, Variable Speed Drives, cooling coils and control valves, filters, dampers, safeties, controls, gages, and vibration isolation).
- n. Computer Room Air Conditioning Systems (CRAC units – including fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, humidifiers, compressors and liquid-cooled condensers, filters, safeties, controls, gages, vibration isolation, condensate pumps, water/leak detection system and alarms, and shunt trip shut down).
- o. Room Pressurization Equipment (Pressure sensors, terminal units/dampers, and controls and alarms).
- p. HVAC Water Treatment Systems (Closed circuits – including shot feeders and final water analysis, open circuits – including water analysis, chemical/biocide tanks, injection

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- piping, chemical/biocide pumps and motors, controls, water meter, and automatic blowdown).
- q. Commercial Kitchen Hoods & Associated Fire Suppression Systems (Fans, motors, Variable Speed Drives, automatic shut down on fire suppression discharge, and gas valve operation).
  - r. Fuel Delivery and Storage Systems for Boilers and Standby Generators (Fuel level monitoring/controls/alarms, transfer pumps and motors, leak detection monitoring/alarms, and fill systems)
5. Electrical (Division 26)
- a. Utility Service Entrance Switchgear (Fuses and circuit breaker settings, metering, mimic diagram, gages, and controls).
  - b. Standby Generator Systems (Automatic transfer switches, fuel delivery pumps and motors, battery charging and instrumentation, muffler and exhaust system, and vibration isolation).
  - c. Generator Paralleling Switchboards (Automatic transfer switches, instrumentation, metering and gages, and controls).
  - d. Generator Power Distribution Systems (Fuses and circuit breaker settings, metering, gages, and controls).
  - e. Utility Power Unit Substations (Transformers and tap settings, fuses and circuit breaker settings, metering, gages, and controls).
  - f. Generator Power Unit Substations (Transformers and tap settings, fuses and circuit breaker settings, metering, gages, and controls).
  - g. Automatic Transfer Switches (Test with associated generator).
  - h. Normal Power Distribution Systems (Grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
  - i. Life Safety Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
  - j. Critical Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
  - k. Essential Equipment Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).

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- l. Lighting Controls (Control system hardware and software, scene settings, zone settings, occupancy sensor interface, and unoccupied cycle control).
- m. Uninterruptible Power Supply Systems and UPS Power Distribution Systems (Battery chargers, static and dynamic power generators – i.e. inverters, MG sets, metering and controls, system power displays, and distribution panel circuit breakers).
6. Communications (Division 27)
  - a. Facility Telecommunications and Data Distribution Systems.
  - b. Nurse Call / Code Blue Systems (Local stations, system hardware and software, reset functions, response time per activation, and notification signals).
  - c. Public Address and Mass Notification Systems (Amplifiers and head-end hardware, speaker volume, and background noise – i.e. hiss or similar interference).
  - d. Healthcare Intercommunications and Program Systems (Local stations, system hardware and software, and notification signals).
7. Electronic Safety and Security (Division 28)
  - a. Fire Detection and Alarm (Master panel and software, addressable units – i.e. pull stations, flow detectors, heat detectors, etc., controls and alarm functions, horns/bells/door releases and other output devices, and fire command center functions – stairwell communications, stairwell pressurization fan start, mechanical systems shutdowns).
8. Site Utility Systems (Division 31)
  - a. Sanitary Sewage Lift Stations (Lift station sump or tank level controls, pump alternator, alarms and alarm panel, pumps and motors).
  - b. Steam Condensate Pump Stations (Condensate receivers and transfer pumps, motors, controls, pump alternator, alarms and instrumentation, and safeties).
  - c. Storm Drainage Pump Systems (Sump level controls, pump alternator, alarms and alarm panel, pumps and motors).

#### 1.7 COMMISSIONING TEAM

##### A. Members Appointed by Contractor:

1. Contractor: The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.
2. Contractor's Commissioning Representative(s): Individual(s), each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and



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subcontractors, installers, suppliers, and specialists deemed appropriate by the Department of Veterans Affairs (VA) and Commissioning Agent.

B. Members Appointed by VA:

1. Commissioning Agent: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The VA will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

#### 1.8 VA'S COMMISSIONING RESPONSIBILITIES

- A. Appoint an individual, company or firm to act as the Commissioning Agent.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
  1. Coordination meetings.
  2. Training in operation and maintenance of systems, subsystems, and equipment.
  3. Testing meetings.
  4. Witness and assist in Systems Functional Performance Testing.
  5. Demonstration of operation of systems, subsystems, and equipment.
- C. Provide the Construction Documents, prepared by Architect and approved by VA, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

#### 1.9 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES

- A. The Contractor shall assign a Commissioning Manager to manage commissioning activities of the Contractor, and subcontractors.
- B. The Contractor shall ensure that the commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with the requirements of these specifications.
- C. The Contractor shall ensure that each installing subcontractor shall assign representatives with expertise and authority to act on behalf of the subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
  1. Participate in commissioning coordination meetings.
  2. Conduct operation and maintenance training sessions in accordance with approved training plans.

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3. Verify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
4. Evaluate commissioning issues and commissioning observations identified in the Commissioning Issues Log, field reports, test reports or other commissioning documents. In collaboration with entity responsible for system and equipment installation, recommend corrective action.
5. Review and comment on commissioning documentation.
6. Participate in meetings to coordinate Systems Functional Performance Testing.
7. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Commissioning Agent for incorporation into the commissioning plan.
8. Provide information to the Commissioning Agent for developing commissioning plan.
9. Participate in training sessions for VA's operation and maintenance personnel.
10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.

#### 1.10 COMMISSIONING AGENT'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Prepare the commissioning plan. See Paragraph 1.11-A of this specification Section for further information.
- C. Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment, including providing gages, controls and other components required to operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.
- D. At the beginning of the construction phase, conduct an initial construction phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.
- E. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.

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- F. Observe construction and report progress, observations and issues. Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with the Construction Documents.
- G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.
- H. Coordinate Systems Functional Performance Testing schedule with the Contractor.
- I. Witness selected systems startups.
- J. Verify selected Pre-Functional Checklists completed and submitted by the Contractor.
- K. Witness and document Systems Functional Performance Testing.
- L. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.

Spec Writer's Note: Coordinate the specification reference in Para J below with the specific project spec section dealing with O&M Data requirements.

- M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00 GENERAL REQUIREMENTS.
- N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.
- O. Prepare commissioning Field Observation Reports.
- P. Prepare the Final Commissioning Report.
- Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.
- R. Assemble the final commissioning documentation, including the Final Commissioning Report and Addendum to the Final Commissioning Report.

#### 1.11 COMMISSIONING DOCUMENTATION

- A. Commissioning Agent's Certification(s): Commissioning Agent shall submit evidence of valid and current certification(s), as required in Section 1.1(G), to the Contracting Officer.

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- B. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:
1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
  2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
  3. Identification of systems and equipment to be commissioned.
  4. Schedule of Commissioning Coordination meetings.
  5. Identification of items that must be completed before the next operation can proceed.
  6. Description of responsibilities of commissioning team members.
  7. Description of observations to be made.
  8. Description of requirements for operation and maintenance training.
  9. Schedule for commissioning activities with dates coordinated with overall construction schedule.
  10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
  11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
  12. Preliminary Systems Functional Performance Test procedures.
- C. Systems Functional Performance Test Procedures: The Commissioning Agent will develop Systems Functional Performance Test Procedures for each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:

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1. Name and identification code of tested system.
  2. Test number.
  3. Time and date of test.
  4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
  5. Dated signatures of the person performing test and of the witness, if applicable.
  6. Individuals present for test.
  7. Observations and Issues.
  8. Issue number, if any, generated as the result of test.
- D. Pre-Functional Checklists: The Commissioning Agent will prepare *Pre-Functional Checklists*. *Pre-Functional Checklists shall be completed* and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.
- E. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.
- Spec Writer Note: Modify Para E below to include a reference to other paragraph(s) that may be included to require that the Contractor is liable for any costs incurred by the VA for retesting. These costs may include additional fees to the Commissioning Agent and/or A/E.
- F. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results.
- G. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents.

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The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.

1. Creating an Commissioning Issues Log Entry:

- a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
- b. Assign a descriptive title for the issue.
- c. Identify date and time of the issue.
- d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
- e. Identify system, subsystem, and equipment to which the issue applies.
- f. Identify location of system, subsystem, and equipment.
- g. Include information that may be helpful in diagnosing or evaluating the issue.
- h. Note recommended corrective action.
- i. Identify commissioning team member responsible for corrective action.
- j. Identify expected date of correction.
- k. Identify person that identified the issue.

2. Documenting Issue Resolution:

- a. Log date correction is completed or the issue is resolved.
- b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
- c. Identify changes to the Contract Documents that may require action.
- d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
- e. Identify person(s) who corrected or resolved the issue.
- f. Identify person(s) verifying the issue resolution.

H. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents

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and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:

1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
  2. Commissioning plan.
  3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
  4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
  5. Commissioning Issues Log.
  6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.
- I. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:
1. Documentation of deferred and off season test(s) results.
  2. Completed Systems Functional Performance Test Procedures for off season test(s).
  3. Documentation that unresolved system performance issues have been resolved.
  4. Updated Commissioning Issues Log, including status of unresolved issues.
  5. Identification of potential Warranty Claims to be corrected by the Contractor.
- J. Systems Manual: The Commissioning Agent will gather required information and compile the Systems Manual. The Systems Manual will include, but is not limited to, the following:
1. Design Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout the Project.
  2. Reference to Final Commissioning Plan.
  3. Reference to Final Commissioning Report.
  4. Approved Operation and Maintenance Data as submitted by the Contractor.

#### 1.12 SUBMITTALS

- A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary Commissioning Plan is included as an Appendix to this specification section. The Preliminary

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Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:

1. The Commissioning Team: A list of commissioning team members by organization.
  2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by the VA).
  3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.
  4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.
  5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, the expected duration and predecessors for the activity.
  6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on the level of detailed information the Contractor shall include on the final submission.
  7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system's testing.
- B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor's project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section. The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.
- C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent.



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The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.

- D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.
- E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.
- F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA Resident Engineer with copies to the Contractor and Architect.
- G. Preliminary Commissioning Report Submittal: The Commissioning Agent will submit three electronic copies of the preliminary commissioning report. One electronic copy, with review comments, will be returned to the Commissioning Agent for preparation of the final submittal.
- H. Final Commissioning Report Submittal: The Commissioning Agent will submit four sets of electronically formatted information of the final commissioning report to the VA. The final submittal will incorporate comments as directed by the VA.
- I. Data for Commissioning:
  - 1. The Commissioning Agent will request in writing from the Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of the Commissioning Plan.
  - 2. The Commissioning Agent may request further documentation as is necessary for the commissioning process or to support other VA data collection requirements, including Construction Operations Building Information Exchange (COBIE), Building Information Modeling (BIM), etc.

#### 1.13 COMMISSIONING PROCESS

- A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.

Spec writer's note: Coordinate the number of days listed in the following paragraphs with the VA Resident Engineer.
- B. Within //XX// days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CM) to manage and lead the commissioning effort on behalf of the Contractor. The Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.

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- C. Within //XX// days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

#### 1.14 QUALITY ASSURANCE

- A. Instructor Qualifications: Factory authorized service representatives shall be experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: The Contractor shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

#### 1.15 COORDINATION

- A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- B. Scheduling: The Contractor will work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.
- C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.
- D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of

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### GENERAL COMMISSIONING REQUIREMENTS

commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

- E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.
- F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

## PART 2 - PRODUCTS

### 2.1 TEST EQUIPMENT

- A. The Contractor shall provide all standard and specialized testing equipment required to perform Systems Functional Performance Testing. Test equipment required for Systems Functional Performance Testing will be identified in the detailed System Functional Performance Test Procedure prepared by the Commissioning Agent.
- B. Data logging equipment and software required to test equipment shall be provided by the Contractor.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 °C (1.0 °F) and a resolution of + or - 0.1 °C (0.2 °F). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

## PART 3 - EXECUTION

### 3.1 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS

- A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1, Systems to Be Commissioned.
  - 1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-

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Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.

- a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.
  - b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.
2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.
- a. The Contractor shall develop the full startup plan by combining (or adding to) the checklists with the manufacturer's detailed startup and checkout procedures from the O&M manual data and the field checkout sheets normally used by the Contractor. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
  - b. The full startup plan shall at a minimum consist of the following items:
    - 1) The Pre-Functional Checklists.
    - 2) The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
    - 3) The manufacturer's normally used field checkout sheets.
      - a) The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.
      - b) The Contractor shall review and evaluate the procedures and the format for documenting them, noting any procedures that need to be revised or added.
3. Sensor and Actuator Calibration
- a. All field installed temperature, relative humidity, CO<sub>2</sub> and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 specifications.

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- b. All procedures used shall be fully documented on the Pre-Functional Checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
- 4. Execution of Equipment Startup
  - a. Four weeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
  - b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
  - c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.
  - d. Only individuals that have direct knowledge and witnessed that a line item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

### 3.2 DEFICIENCIES, NONCONFORMANCE, AND APPROVAL IN CHECKLISTS AND STARTUP

- A. The Contractor shall clearly list any outstanding items of the initial startup and Pre-Functional Checklist procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the VA and the Commissioning Agent within two days of completion.
- B. The Commissioning Agent will review the report and submit comments to the VA. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning Agent will involve the VA and others as necessary. The Contractor shall correct all areas that are noncompliant or incomplete in the checklists in a timely manner, and shall notify the VA and Commissioning Agent as soon as outstanding items have been corrected. The Contractor shall submit an updated startup report and a Statement of Correction on the original noncompliance report. When satisfactorily completed, the Commissioning Agent will recommend approval of the checklists and startup of each system to the VA.
- C. The Contractor shall be responsible for resolution of deficiencies as directed the VA.

### 3.3 PHASED COMMISSIONING

- A. The project may require startup and initial checkout to be executed in phases. This phasing shall be planned and scheduled in a coordination meeting of the VA, Commissioning Agent, and the Contractor. Results will be added to the master construction schedule and the commissioning schedule.

GENERAL COMMISSIONING REQUIREMENTS

3.4 TRENDING AND ALARMS

- A. Trending is a method of testing as a standalone method or to augment manual testing. The Contractor shall trend any and all points of the system or systems at intervals specified below.
- B. Alarms are a means to notify the system operator that abnormal conditions are present in the system. Alarms shall be structured into three tiers – Critical, Priority, and Maintenance.
  - 1. Critical alarms are intended to be alarms that require the immediate attention of and action by the Operator. These alarms shall be displayed on the Operator Workstation in a popup style window that is graphically linked to the associated unit's graphical display. The popup style window shall be displayed on top of any active window within the screen, including non DDC system software.
  - 2. Priority level alarms are to be printed to a printer which is connected to the Operator's Work Station located within the engineer's office. Additionally Priority level alarms shall be able to be monitored and viewed through an active alarm application. Priority level alarms are alarms which shall require reaction from the operator or maintenance personnel within a normal work shift, and not immediate action.
  - 3. Maintenance alarms are intended to be minor issues which would require examination by maintenance personnel within the following shift. These alarms shall be generated in a scheduled report automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer's office.
- C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and commissioning. This network will allow project team members to more effectively program, view, manipulate and test control devices while being in the same room as the controlled device.
- D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the Resident Engineer and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:

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1. Pre-testing, Testing, and Post-testing - Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the Resident Engineer. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the Resident Engineer, prior to the execution of Systems Functional Performance Testing.
2. Dynamic plotting - The Contractor shall also provide dynamic plotting during Systems Functional Performance testing at frequent intervals for points determined by the Systems Functional Performance Test Procedure. The graphical plots will be formatted and plotted at durations listed in the Systems Functional Performance Test Procedure.
3. Graphical plotting - The graphical plots shall be provided with a dual y-axis allowing 15 or more trend points (series) plotted simultaneously on the graph with each series in distinct color. The plots will further require title, axis naming, legend etc. all described by the Systems Functional Performance Test Procedure. If this cannot be sufficiently accomplished directly in the Direct Digital Control System then it is the responsibility of the Contractor to plot these trend logs in Microsoft Excel.
4. The following tables indicate the points to be trended and alarmed by system. The Operational Trend Duration column indicates the trend duration for normal operations. The Testing Trend Duration column indicates the trend duration prior to Systems Functional Performance Testing and again after Systems Functional Performance Testing. The Type column indicates point type: AI = Analog Input, AO = Analog Output, DI = Digital Input, DO = Digital Output, Calc = Calculated Point. In the Trend Interval Column, COV = Change of Value. The Alarm Type indicates the alarm priority; C = Critical, P = Priority, and M = Maintenance. The Alarm Range column indicates when the point is considered in the alarm state. The Alarm Delay column indicates the length of time the point must remain in an alarm state before the alarm is recorded in the DDC. The intent is to allow minor, short-duration events to be corrected by the DDC system prior to recording an alarm.

Spec Writer Note: The following tables provide guidelines for system trends and alarms. Coordinate the types of systems and point names with the construction documents. Verify alarm priorities, ranges and delay. The Design Engineer may elect to include trending and alarm information on the DDC Control Schematics and

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Sequences of Operations in the Construction Drawing set or in the DDC Control Specifications. Verify the control drawings or DDC specification has included reference to this section of 01 91 00. If adequately included in the drawings or specifications, the following tables should be deleted to prevent duplication and possible conflicts.

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
OA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Humidity	AI	15 Min	24 hours	3 days	P	>60% RH	10 min
Mixed Air Temp	AI	None	None	None	N/A		
SA Temp	AI	15 Min	24 hours	3 days	C	±5°F from SP	10 min
Supply Fan Speed	AI	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AI	15 Min	24 hours	3 days	N/A		
RA Pre-Filter Status	AI	None	None	None	N/A		
OA Pre-Filter Status	AI	None	None	None	N/A		
After Filter Status	AI	None	None	None	N/A		
SA Flow	AI	15 Min	24 hours	3 days	C	±10% from SP	10 min
OA Supply Temp	AI	15 Min	24 hours	3 days	P	±5°F from SP	10 min
RA Supply Temp	AI	15 Min	24 hours	3 days	N/A		
RA CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA HW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
RA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
Initial UVC Intensity (%)	AI	None	None	None	N/A		



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## GENERAL COMMISSIONING REQUIREMENTS

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Duct Pressure	AI	15 Min	24 hours	3 days	C	±25% from SP	6 min
CO2 Level	AI	15 Min	24 hours	3 days	P	±10% from SP	10 min
Supply Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Return Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 Min
High Static Status	DI	COV	24 hours	3 days	P	True	1 min
Fire Alarm Status	DI	COV	24 hours	3 days	C	True	5 min
Freeze Stat Level 1	DI	COV	24 hours	3 days	C	True	10 min
Freeze Stat Level 2	DI	COV	24 hours	3 days	C	True	5 min
Freeze Stat Level 3	DI	COV	24 hours	3 days	P	True	1 min
Fire/Smoke Damper Status	DI	COV	24 hours	3 days	P	Closed	1 min
Emergency AHU Shutdown	DI	COV	24 hours	3 days	P	True	1 min
Exhaust Fan #1 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Exhaust Fan #2 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Exhaust Fan #3 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
OA Alarm	DI	COV	24 hours	3 days	C	True	10 min
High Static Alarm	DI	COV	24 hours	3 days	C	True	10 min
UVC Emitter Alarm	DI	COV	24 hours	3 days	P	True	10 min
CO2 Alarm	DI	COV	24 hours	3 days	P	True	10 min
Power Failure	DI	COV	24 hours	3 days	P	True	1 min
Supply Fan Speed	AO	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AO	15 Min	24 hours	3 days	N/A		
RA CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
OA CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		

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Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
OA HW Valve Position	AO	15 Min	24 hours	3 days	N/A		
Supply Fan S/S	DO	COV	24 hours	3 days	N/A		
Return Fan S/S	DO	COV	24 hours	3 days	N/A		
Fire/Smoke Dampers	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
AHU Energy	Calc	1 Hour	30 day	N/A	N/A		

Terminal Unit (VAV, CAV, etc.) Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Space Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Air Flow	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Local Setpoint	AI	15 Min	12 hours	3 days	M	±10°F from SP	60 min
Space Humidity	AI	15 Min	12 hours	3 days	P	> 60% RH	5 min
Unoccupied Override	DI	COV	12 hours	3 days	M	N/A	12 Hours

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<b>Terminal Unit (VAV, CAV, etc.) Trending and Alarms</b>							
<b>Point</b>	<b>Type</b>	<b>Trend Interval</b>	<b>Operational Trend Duration</b>	<b>Testing Trend Duration</b>	<b>Alarm Type</b>	<b>Alarm Range</b>	<b>Alarm Delay</b>
Refrigerator Alarm	DI	COV	12 hours	3 days	C	N/A	10 min
Damper Position	AO	15 Minutes	12 hours	3 days	N/A		
Heating coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		

<b>4-Pipe Fan Coil Trending and Alarms</b>							
<b>Point</b>	<b>Type</b>	<b>Trend Interval</b>	<b>Operational Trend Duration</b>	<b>Testing Trend Duration</b>	<b>Alarm Type</b>	<b>Alarm Range</b>	<b>Alarm Delay</b>
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Pre-Filter Status	AI	None	None	None	M	> SP	1 hour
Water Sensor	DI	COV	12 hours	3 days	M	N/A	30 Min
Cooling Coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Heating coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Fan Coil ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

<b>2-Pipe Fan Coil Unit Trending and Alarms</b>
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<b>Point</b>	<b>Type</b>	<b>Trend Interval</b>	<b>Operational Trend Duration</b>	<b>Testing Trend Duration</b>	<b>Alarm Type</b>	<b>Alarm Range</b>	<b>Alarm Delay</b>
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Pre-Filter Status	AI	None	None	None	M	> SP	1 hour
Water Sensor	DI	COV	12 hours	3 days	M	N/A	30 Min
Cooling Coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Fan Coil ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

<b>Unit Heater Trending and Alarms</b>							
<b>Point</b>	<b>Type</b>	<b>Trend Interval</b>	<b>Operational Trend Duration</b>	<b>Testing Trend Duration</b>	<b>Alarm Type</b>	<b>Alarm Range</b>	<b>Alarm Delay</b>
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Heating Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Unit Heater ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

<b>Steam and Condensate Pumps Trending and Alarms</b>
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**GENERAL COMMISSIONING REQUIREMENTS**

<b>Point</b>	<b>Type</b>	<b>Trend Interval</b>	<b>Operational Trend Duration</b>	<b>Testing Trend Duration</b>	<b>Alarm Type</b>	<b>Alarm Range</b>	<b>Alarm Delay</b>
Steam Flow (LB/HR)	AI	15 Minutes	12 hours	3 days	N/A		
Condensate Pump Run Hours	AI	15 Minutes	12 hours	3 days	N/A		
Water Meter (GPM)	AI	15 Minutes	12 hours	3 days	N/A		
Electric Meter (KW/H)	AI	15 Minutes	12 hours	3 days	N/A		
Irrigation Meter (GPM)	AI	15 Minutes	12 hours	3 days	N/A		
Chilled Water Flow (TONS)	AI	15 Minutes	12 hours	3 days	N/A		
Condensate Flow (GPM)	AI	15 Minutes	12 hours	3 days	N/A		
High Water Level Alarm	DI	COV	12 hours	3 days	C	True	5 Min
Condensate Pump Start/Stop	DO	COV	12 hours	3 days	P	Status <> Command	10 min

<b>Domestic Hot Water Trending and Alarms</b>							
<b>Point</b>	<b>Type</b>	<b>Trend Interval</b>	<b>Operational Trend Duration</b>	<b>Testing Trend Duration</b>	<b>Alarm Type</b>	<b>Alarm Range</b>	<b>Alarm Delay</b>
Domestic HW Setpoint WH-1	AI	15 Minute	12 Hours	3 days	N/A		
Domestic HW Setpoint WH-2	AI	15 Minute	12 Hours	3 days	N/A		
Domestic HW Temperature	AI	15 Minute	12 Hours	3 days	C	> 135 °F	10 Min
Domestic HW Temperature	AI	15 Minute	12 Hours	3 days	P	±5°F from SP	10 Min
Dom. Circ. Pump #1 Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Dom. Circ. Pump #2 Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min

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## GENERAL COMMISSIONING REQUIREMENTS

Domestic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Dom. Circ. Pump #1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Dom. Circ. Pump #2 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Domestic HW Start/Stop	DO	COV	12 Hours	3 days	N/A		

Hydronic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
System HWS Temperature	AI	15 min	12 hours	3 days	C	±5°F from SP	10 Min
System HWR Temperature	AI	15 min	12 hours	3 days	M	±15°F from SP	300 Min
HX-1 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Leaving Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
System Flow (GPM)	AI	15 min	12 hours	3 days	N/A		
System Differential Pressure	AI	15 min	12 hours	3 days	P	±10% from SP	8 Min
				3 days			
HW Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 1 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 2 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		

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Hydronic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Steam Station #1 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #1 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #2 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #2 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station By-pass Valve Position	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HW Pump 2 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HWR #1 Valve	DO	COV	12 Hours	3 days	N/A		
HWR #2 Valve	DO	COV	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller 1 Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min
Chiller 1 Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		

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Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller 2 Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min
Chiller 2 Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Decoupler Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Differential Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min
Secondary Loop Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Return Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Primary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		



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Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller 1 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Chiller 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 2 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller 2 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller 2 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Detector	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Exhaust Fan Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Emergency Shut-down	DI	COV	12 Hours	3 days	P	True	1 Min
Primary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Primary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Chiller 1 Enable	DO	COV	12 Hours	3 days	N/A		
Chiller 1 Iso-Valve Command	DO	COV	12 Hours	3 days	N/A		

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Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller 2 Enable	DO	COV	12 Hours	3 days	N/A		
Chiller 2 Iso-Valve Command	DO	COV	12 Hours	3 days	N/A		
Refrigerant Exhaust Fan Start / Stop	DO	COV	12 Hours	3 days	N/A		

Condenser Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller 1 Condenser Entering Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Condenser Leaving Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Condenser Entering Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Condenser Leaving Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Supply Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Return Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Basin Temp	AI	15 Minutes	12 Hours	3 days	P	< 45 °F	10 Min
Cooling Tower 2 Supply Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Return Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Basin Temp	AI	15 Minutes	12 Hours	3 days	P	< 45 °F	10 Min
Condenser Water Supply Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Condenser Water Return Temp	AI	15 Minutes	12 Hours	3 days	N/A		

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Condenser Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Outdoor Air Wet Bulb	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Fan Status	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Cooling Tower 1 Basin Heat	DI	COV	12 Hours	3 days	N/A		
Cooling Tower 1 Heat Trace	DI	COV	12 Hours	3 days	N/A		
Cooling Tower 2 Fan Status	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Cooling Tower 2 Basin Heat	DI	COV	12 Hours	3 days	N/A		
Cooling Tower 2 Heat Trace	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Isolation Valve	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Chiller 2 Isolation Valve	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Condenser Water Pump 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Condenser Water Pump 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Chiller 1 Condenser Bypass Valve	AO	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Condenser By-Pass Valve	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Bypass Valve	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Fan Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Bypass Valve	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Fan Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Fan Start / Stop	DO	COV	12 Hours	3 days	N/A		
Cooling Tower 2 Fan Start / Stop	DO	COV	12 Hours	3 days	N/A		

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Condenser Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Condenser Water Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Condenser Water Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		

Steam Boiler System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Boiler 1 Steam Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min
Boiler 1 Steam Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Steam Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min
Boiler 2 Steam Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
System Steam Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min
Boiler 1 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 1 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Boiler 1 on Fuel Oil	DI	COV	12 Hours	3 days	N/A		
Boiler 1 Low Water Alarm	DI	COV	12 Hours	3 days	C	True	5 Min
Boiler 1 High Water Alarm	DI	COV	12 Hours	3 days	C	True	5 Min

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Steam Boiler System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Boiler 1 Feed Pump	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 2 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Boiler 2 on Fuel Oil	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Low Water Alarm	DI	COV	12 Hours	3 days	C	True	5 Min
Boiler 2 High Water Alarm	DI	COV	12 Hours	3 days	C	True	5 Min
Boiler 2 Feed Pump	DI	COV	12 Hours	3 days	N/A		
Combustion Damper Status	DI	COV	12 Hours	3 days	P	Status <> Command	5 min
Condensate Recovery Pump Status	DI	COV	12 Hours	3 days	P	Status <> Command	5 min
Boiler 1 Feed Pump Start / Stop	DO	COV	12 Hours	3 days	N/A		
Boiler 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Combustion Damper Command	DO	COV	12 Hours	3 days	N/A		
Condensate Recovery Pump Start / Stop	DO	COV	12 Hours	3 days	N/A		

Hot Water Boiler System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay

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Hot Water Boiler System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Outside Air Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Entering Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Leaving Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Entering Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Leaving Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Hot Water Supply Temperature	AI	15 Minutes	12 Hours	3 days	P	±5 °F from SP	10 Min
Hot Water Return Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Differential Pressure	AI	15 Minutes	12 Hours	3 days	C	±5% from SP	10 Min
Lead Boiler	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 1 Isolation Valve	DI	COV	12 Hours	3 days	N/A		
Boiler 1 on Fuel Oil	DI	COV	12 Hours	3 days	N/A		
Boiler 1 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Boiler 2 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 2 Isolation Valve	DI	COV	12 Hours	3 days	N/A		
Boiler 2 on Fuel Oil	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min

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Hot Water Boiler System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Combustion Dampers Open	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Secondary Pump 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Secondary Pump 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 1 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Primary Pump 2 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Hot Water System Enable	DO	COV	12 Hours	3 days	N/A		
Combustion Dampers Command	DO	COV	12 Hours	3 days	N/A		
Primary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Primary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		

E. The Contractor shall provide the following information prior to Systems Functional Performance Testing. Any documentation that is modified after submission shall be recorded and resubmitted to the Resident Engineer and Commissioning Agent.

1. Point-to-Point checkout documentation;

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2. Sensor field calibration documentation including system name, sensor/point name, measured value, DDC value, and Correction Factor.
3. A sensor calibration table listing the referencing the location of procedures to following in the O&M manuals, and the frequency at which calibration should be performed for all sensors, separated by system, subsystem, and type. The calibration requirements shall be submitted both in the O&M manuals and separately in a standalone document containing all sensors for inclusion in the commissioning documentation. The following table is a sample that can be used as a template for submission.

SYSTEM		
Sensor	Calibration Frequency	O&M Calibration Procedure Reference
Discharge air temperature	Once a year	Volume I Section D.3.aa
Discharge static pressure	Every 6 months	Volume II Section A.1.c

4. Loop tuning documentation and constants for each loop of the building systems. The documentation shall be submitted in outline or table separated by system, control type (e.g. heating valve temperature control); proportional, integral and derivative constants, interval (and bias if used) for each loop. The following table is a sample that can be used as a template for submission.

AIR HANDLING UNIT AHU-1				
Control Reference	Proportional Constant	Integral Constant	Derivative Constant	Interval
Heating Valve Output	1000	20	10	2 sec.

### 3.5 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

- A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.
- B. Objectives and Scope: The objective of Systems Functional Performance Testing is to demonstrate that each system is operating according to the Contract Documents. Systems Functional Performance Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of noncompliant performance are identified and corrected, thereby improving the operation and functioning of the systems. In general, each system shall be operated through all modes of



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operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire alarm and emergency power) where there is a specified system response. The Contractor shall verify each sequence in the sequences of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

- C. Development of Systems Functional Performance Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements found in the Contract Documents and approved submittals and shop drawings, the Commissioning Agent will develop specific Systems Functional Test Procedures to verify and document proper operation of each piece of equipment and system to be commissioned. The Contractor shall assist the Commissioning Agent in developing the Systems Functional Performance Test procedures as requested by the Commissioning Agent i.e. by answering questions about equipment, operation, sequences, etc. Prior to execution, the Commissioning Agent will provide a copy of the Systems Functional Performance Test procedures to the VA, the Architect/Engineer, and the Contractor, who shall review the tests for feasibility, safety, equipment and warranty protection.
- D. Purpose of Test Procedures: The purpose of each specific Systems Functional Performance Test is to verify and document compliance with the stated criteria of acceptance given on the test form. Representative test formats and examples are found in the Commissioning Plan for this project. (The Commissioning Plan is issued as a separate document and is available for review.) The test procedure forms developed by the Commissioning Agent will include, but not be limited to, the following information:
1. System and equipment or component name(s)
  2. Equipment location and ID number
  3. Unique test ID number, and reference to unique Pre-Functional Checklists and startup documentation, and ID numbers for the piece of equipment.
  4. Date
  5. Project name
  6. Participating parties
  7. A copy of the specification section describing the test requirements
  8. A copy of the specific sequence of operations or other specified parameters being verified
  9. Formulas used in any calculations

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10. Required pretest field measurements
  11. Instructions for setting up the test.
  12. Special cautions, alarm limits, etc.
  13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
  14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
  15. A section for comments.
  16. Signatures and date block for the Commissioning Agent. A place for the Contractor to initial to signify attendance at the test.
- E. Test Methods: Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe performance) and/or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.
1. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.
  2. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
  3. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
  4. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.

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5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.
- F. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.
- G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.
- Spec Writer Note: Verify that the following paragraph regarding cost of expanded sample testing is allowed for the specific project. Retain or delete the paragraph as necessary.
- H. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- I. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.
- J. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the VA before it is used to

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verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance Testing will proceed from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems will be checked.

- K. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

### 3.6 DOCUMENTATION, NONCONFORMANCE AND APPROVAL OF TESTS

- A. Documentation: The Commissioning Agent will witness, and document the results of all Systems Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to the VA and the Contractor for review and approval. The Contractor shall include the filled out forms with the O&M manual data.
- B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form. All items of nonconformance issues will be noted and reported to the VA on Commissioning Field Reports and/or the Commissioning Master Issues Log.
1. Corrections of minor items of noncompliance identified may be made during the tests. In such cases, the item of noncompliance and resolution shall be documented on the Systems Functional Test Procedure.
  2. Every effort shall be made to expedite the systems functional Performance Testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Agent shall not be pressured into overlooking noncompliant work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so by direction from the VA.
  3. As the Systems Functional Performance Tests progresses and an item of noncompliance is identified, the Commissioning Agent shall discuss the issue with the Contractor and the VA.
  4. When there is no dispute on an item of noncompliance, and the Contractor accepts responsibility to correct it:
    - a. The Commissioning Agent will document the item of noncompliance and the Contractor's response and/or intentions. The Systems Functional Performance Test then continues or proceeds to another test or sequence. After the day's work is complete, the Commissioning Agent will submit a Commissioning Field Report to the VA. The

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Commissioning Agent will also note items of noncompliance and the Contractor's response in the Master Commissioning Issues Log. The Contractor shall correct the item of noncompliance and report completion to the VA and the Commissioning Agent.

- b. The need for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test and the test shall be repeated.
5. If there is a dispute about item of noncompliance, regarding whether it is an item of noncompliance, or who is responsible:
  - a. The item of noncompliance shall be documented on the test form with the Contractor's response. The item of noncompliance with the Contractor's response shall also be reported on a Commissioning Field Report and on the Master Commissioning Issues Log.
  - b. Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive and acceptance authority is with the Department of Veterans Affairs.
  - c. The Commissioning Agent will document the resolution process.
  - d. Once the interpretation and resolution have been decided, the Contractor shall correct the item of noncompliance, report it to the Commissioning Agent. The requirement for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test. Retesting shall be repeated until satisfactory performance is achieved.

Spec Writer Note: Verify that the following paragraph regarding cost of retesting is allowed for the specific project. Retain or delete the paragraph as necessary.

- C. Cost of Retesting: The cost to retest a System Functional Performance Test shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

Spec Writer's Note: Verify that the paragraph and subparagraphs below do not conflict with other general or specific contract documents regarding manufacturer's defects. Retain, delete, or modify the paragraphs accordingly.

- D. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform in compliance with the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance specifications, all identical units may be considered unacceptable by the VA. In such case, the Contractor shall provide the VA with the following:

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### GENERAL COMMISSIONING REQUIREMENTS

1. Within one week of notification from the VA, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the VA within two weeks of the original notice.
  2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
  3. The VA shall determine whether a replacement of all identical units or a repair is acceptable.
  4. Two examples of the proposed solution shall be installed by the Contractor and the VA shall be allowed to test the installations for up to one week, upon which the VA will decide whether to accept the solution.
  5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- E. Approval: The Commissioning Agent will note each satisfactorily demonstrated function on the test form. Formal approval of the Systems Functional Performance Test shall be made later after review by the Commissioning Agent and by the VA. The Commissioning Agent will evaluate each test and report to the VA using a standard form. The VA will give final approval on each test using the same form, and provide signed copies to the Commissioning Agent and the Contractor.

### 3.7 DEFERRED TESTING

- A. Unforeseen Deferred Systems Functional Performance Tests: If any Systems Functional Performance Test cannot be completed due to the building structure, required occupancy condition or other conditions, execution of the Systems Functional Performance Testing may be delayed upon approval of the VA. These Systems Functional Performance Tests shall be conducted in the same manner as the seasonal tests as soon as possible. Services of the Contractor to conduct these unforeseen Deferred Systems Functional Performance Tests shall be negotiated between the VA and the Contractor.
- B. Deferred Seasonal Testing: Deferred Seasonal Systems Functional Performance Tests are those that must be deferred until weather conditions are closer to the systems design parameters. The Commissioning Agent will review systems parameters and recommend which Systems Functional Performance Tests should be deferred until weather conditions more closely match systems parameters. The Contractor shall review and comment on the proposed schedule for

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### GENERAL COMMISSIONING REQUIREMENTS

Deferred Seasonal Testing. The VA will review and approve the schedule for Deferred Seasonal Testing. Deferred Seasonal Systems Functional Performances Tests shall be witnessed and documented by the Commissioning Agent. Deferred Seasonal Systems Functional Performance Tests shall be executed by the Contractor in accordance with these specifications.

### 3.8 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

- A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's Resident Engineer, VA's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.
- B. The Contractor shall provide training and demonstration as required by other Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 sections. The Training and Demonstration shall include, but is not limited to, the following:
  - 1. Review the Contract Documents.
  - 2. Review installed systems, subsystems, and equipment.
  - 3. Review instructor qualifications.
  - 4. Review instructional methods and procedures.
  - 5. Review training module outlines and contents.
  - 6. Review course materials (including operation and maintenance manuals).
  - 7. Review and discuss locations and other facilities required for instruction.
  - 8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
  - 9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.
- C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:
  - 1. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. At completion of training, submit two complete training manuals for VA's use.
  - 2. Qualification Data: Submit qualifications for facilitator and/or instructor.
  - 3. Attendance Record: For each training module, submit list of participants and length of instruction time.

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### GENERAL COMMISSIONING REQUIREMENTS

4. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
5. Demonstration and Training Videotapes: Submit two copies within seven days of end of each training module.
  - a. Identification: On each copy, provide an applied label with the following information:
    - 1) Name of Project.
    - 2) Name and address of photographer
    - 3) Name of Contractor.
    - 4) Date videotape was recorded.
    - 5) Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
6. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

#### D. QUALITY ASSURANCE

1. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
2. Instructor Qualifications: A factory authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
3. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

#### E. COORDINATION

1. Coordinate instruction schedule with VA's operations. Adjust schedule as required to minimize disrupting VA's operations.
2. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
3. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by the VA.

#### F. INSTRUCTION PROGRAM



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### GENERAL COMMISSIONING REQUIREMENTS

1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
  - a. Fire protection systems, including fire alarm, fire pumps, and fire suppression systems.
  - b. Intrusion detection systems.
  - c. Conveying systems, including elevators, wheelchair lifts, escalators, and automated materials handling systems.
  - d. Medical equipment, including medical gas equipment and piping.
  - e. Laboratory equipment, including laboratory air and vacuum equipment and piping.
  - f. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping, condensate return systems, heating hot water heat exchangers, and heating hot water distribution piping.
  - g. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
  - h. HVAC systems, including air handling equipment, air distribution systems, and terminal equipment and devices.
  - i. switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
  - j. Packaged engine generators, including synchronizing switchgear/switchboards, and transfer switches.
  - k. Lighting equipment and controls.
  - l. Communication systems, including intercommunication, surveillance, nurse call systems, public address, mass evacuation, voice and data, and entertainment television equipment.
  - m. Site utilities including lift stations, condensate pumping and return systems, and storm water pumping systems.
- G. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participants are expected to master. For each module, include instruction for the following:
  1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.

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### GENERAL COMMISSIONING REQUIREMENTS

- e. Equipment function.
  - f. Operating characteristics.
  - g. Limiting conditions.
  - h. Performance curves.
2. Documentation: Review the following items in detail:
- a. Emergency manuals.
  - b. Operations manuals.
  - c. Maintenance manuals.
  - d. Project Record Documents.
  - e. Identification systems.
  - f. Warranties and bonds.
  - g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
- a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:

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### GENERAL COMMISSIONING REQUIREMENTS

- a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
  6. Troubleshooting: Include the following:
    - a. Diagnostic instructions.
    - b. Test and inspection procedures.
  7. Maintenance: Include the following:
    - a. Inspection procedures.
    - b. Types of cleaning agents to be used and methods of cleaning.
    - c. List of cleaning agents and methods of cleaning detrimental to product.
    - d. Procedures for routine cleaning
    - e. Procedures for preventive maintenance.
    - f. Procedures for routine maintenance.
    - g. Instruction on use of special tools.
  8. Repairs: Include the following:
    - a. Diagnosis instructions.
    - b. Repair instructions.
    - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    - d. Instructions for identifying parts and components.
    - e. Review of spare parts needed for operation and maintenance.
- H. Training Execution:
1. Preparation: Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual. Set up instructional equipment at instruction location.
  2. Instruction:
    - a. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Department of Veterans Affairs for number of participants, instruction times, and location.
    - b. Instructor: Engage qualified instructors to instruct VA's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
      - 1) The Commissioning Agent will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.

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### GENERAL COMMISSIONING REQUIREMENTS

- 2) The VA will furnish an instructor to describe VA's operational philosophy.
  - 3) The VA will furnish the Contractor with names and positions of participants.
  3. Scheduling: Provide instruction at mutually agreed times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with the VA and the Commissioning Agent with at least seven days' advance notice.
  4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of **an oral, or a written**, performance-based test.
  5. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.
- I. Demonstration and Training Recording:
1. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.
  2. Video Format: Provide high quality color DVD color on standard size DVD disks.
  3. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
  4. Narration: Describe scenes on videotape by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

----- END -----

**SECTION 03 10 00  
CONCRETE FORMING AND ACCESSORIES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Form accessories.
- C. Form stripping.

**1.2 RELATED SECTIONS**

- A. Section 03 20 00, CONCRETE REINFORCING.
- B. Section 03 30 00, CAST-IN-PLACE CONCRETE.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 34 00, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, blockouts, locations of chamfer and reveal strips, locations of pour pockets, locations and methods for supporting other structural work, proposed construction joint locations, and arrangement of joints and ties. Drawings are to be prepared by, signed and sealed by a Professional Engineer registered in the State of Oregon.
- C. Shoring Drawings: All shoring and re-shoring drawings are to be prepared by, signed and sealed by a Professional Engineer registered in the State of Oregon.

**PART 2 - PRODUCTS**

**2.1 FORMWORK - GENERAL**

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.
- C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.
- D. Comply with relevant portions of ACI 347, ACI 301, and ACI 318.

**2.2 WOOD FORM MATERIALS**

- A. Form Materials: At the discretion of the Contractor.

**2.3 FORM WORK ACCESSORIES**

- A. Form Ties: Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, 1-1/2 inch back break dimension, free of defects that could leave holes, fractures, spalls, or other surface defects larger than 1 inch in concrete

**SECTION 03 10 00**  
**CONCRETE FORMING AND ACCESSORIES**

surface.

- B. Form Release Agent: Colorless, free from oils, that will not stain concrete or impair natural bonding of concrete finish coatings. Form release agents are to comply with the local air quality management districts maximum allowable VOC content.
- C. Corners: Chamfered, rigid plastic type; 3/4X3/4 inch size, unless otherwise indicated on drawings; maximum possible lengths.
- D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- E. Foam Tape: 1/8 inch thick adhesive backed closed cell PVC foam tape with tape width corresponding to edge thickness of plywood.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.
- B. Verify earth form excavations are neatly and accurately cut.

**3.2 EARTH FORMS**

- A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

**3.3 ERECTION - FORMWORK**

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members that are not indicated on drawings.
- F. Provide chamfer strips on external corners of beams, columns, and walls, unless otherwise indicated on drawings.
- G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- H. Coordinate this section with other sections of work that require attachment of

**SECTION 03 10 00**  
**CONCRETE FORMING AND ACCESSORIES**

components to formwork.

- I. Do not reuse formwork with patches or repairs that would result in adverse effects to exposed concrete.
- J. Verify that reinforcing steel has specified concrete cover over reinforcement and has been inspected prior to concealing with formwork.

**3.4 APPLICATION - FORM RELEASE AGENT**

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

**3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS**

- A. Locate and set in place items that will be cast directly into concrete.
- B. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- C. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- D. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- E. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

**3.6 FORM CLEANING**

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
  - 1. Flush with water or use compressed air to remove remaining foreign matter.Ensure that water and debris drain to exterior through clean-out ports.

**3.7 FORMWORK TOLERANCES**

- A. Construct formwork to maintain tolerances required by ACI 117.

**3.8 FORM REMOVAL**

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Form and Shoring Removal:

**SECTION 03 10 00**  
**CONCRETE FORMING AND ACCESSORIES**

1. Bottom forms for mildly reinforced slabs, beams, and girders: 7 days and  $f'_c=2800$  psi.
  2. Side forms for beams and girders: 3 days.
  3. Forms for columns and walls: 3 days.
  4. Forms for footings, pile caps, and grade beams: 2 days.
- C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- D. Store removed forms to prevent damage to form materials or to fresh concrete.  
Discard damaged forms.

- - - E N D - - -



**SECTION 03 20 00  
CONCRETE REINFORCING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

**1.2 RELATED SECTIONS**

- A. Section 03 10 00, CONCRETE FORMING AND ACCESSORIES.
- B. Section 03 30 00, CAST-IN-PLACE CONCRETE.

**PART 2 - PRODUCTS**

**2.1 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420) for #7 and smaller bars.
  - 1. Deformed billet-steel bars.
  - 2. Unfinished.
- B. Reinforcing Steel: ASTM A 706/A 706M, Grade 60 (420) for #8 and larger bars and all bars to be welded. Permitted for bars #7 and smaller.
  - 1. Deformed low-alloy steel bars
  - 2. Unfinished.

**2.2 REINFORCEMENT ACCESSORIES**

- A. Tie Wire: Annealed, minimum 16 gage.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
- C. Bar Supports placed against ground: Precast concrete blocks not less than 3 inches square with embedded wires.
- D. Mechanical Couplers:
  - 1. Manufacturers:
    - a. Headed Reinforcement Corporation (HRC); Product: Xtender: [www.hrc-usa.com](http://www.hrc-usa.com)
    - b. Erico; Product: Threaded or Interlock Coupler: [www.erico.com](http://www.erico.com)
    - c. Erico; Product: CADWELD: [www.erico.com](http://www.erico.com)
    - d. Erico; Product: Lenton Lock B-Series [www.erico.com](http://www.erico.com)
- E. Mechanical Anchors:
  - 1. Manufacturers:
    - a. Headed Reinforcement Corporation (HRC); Product: 100 or 200 Series:

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CONCRETE REINFORCING**

www.hrc-usa.com

- b. Headed Reinforcement Corporation (HRC); Product: Xtender 500 Series Round or Rectangular: www.hrc-usa.com
- c. Erico; Product: Terminator: www.erico.com

**2.3 FABRICATION**

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice, ACI SP-66 - ACI Detailing Manual, ACI 318, and ACI 301.
- B. Welding of reinforcement is permitted only where indicated on drawings. Perform welding in accordance with AWS D1.4.
- C. Mechanical couplers may be substituted for contact lap splices as permitted on drawings.
- D. Locate reinforcing splices not indicated on drawings at point of minimum stress.
  - 1. Stagger splice locations so that no more than 50% of the bars are spliced at a section.
  - 2. Locations of splices subject to approval by Architect.

**PART 3 - EXECUTION**

**3.1 PLACEMENT**

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position by more than the tolerances set forth in ACI 301.
- B. Do not displace or damage vapor barrier and water proofing membrane.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing as indicated on drawings.
- E. Conform to applicable code for concrete cover over reinforcement.
- F. Clean reinforcement of loose rust and mill scale, oil, grease, earth, ice, and other materials, which reduce or destroy bond with concrete.
- G. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- H. Welding:
  - 1. Welding of crossing bars is not permitted.
  - 2. Protect adjacent reinforcement against arc strikes during welding.
- I. Do not bend or realign reinforcement after being embedded in hardened concrete.

**3.2 FIELD QUALITY CONTROL**

- A. An independent testing agency, as specified in Division 1, will inspect installed reinforcement for conformance to contract documents before concrete placement.

**SECTION 03 20 00**  
**CONCRETE REINFORCING**

- B. Visually Inspect 100 percent of mechanical coupler installations.
- C. Inspect placement, location, splices, spacing, size, cover and type of reinforcement for conformance with the contract documents.
- D. Visually inspect placement of flat slab shear reinforcing for conformance with the contract documents and manufacturer recommendations.

- - - E N D - - -



**SECTION 03 30 00  
CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies cast-in-place structural concrete and materials and mixes for other concrete and grout.

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete roads, walks, and similar exterior site work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- C. Section 03 10 00, CONCRETE FORMING AND ACCESSORIES
- D. Section 03 20 00, CONCRETE REINFORCING
- E. Section 05 12 00, STRUCTURAL STEEL FRAMING.
- E. Concrete Color: Section 09 06 00, SCHEDULE FOR FINISHES

**1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN:**

- A. Testing agency retained and reimbursed by the Contractor and approved by Resident Engineer.
- B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.
- C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

**1.4 TOLERANCES:**

- A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).
- B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.
- C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more

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**CAST-IN-PLACE CONCRETE**

than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).

- D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:
1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.
  2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
  3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

**1.5 REGULATORY REQUIREMENTS:**

- A. ACI 315 - Details and Detailing of Concrete Reinforcement.
- B. ACI 318 - Building Code Requirements for Structural Concrete.
- C. ACI 301 - Specifications for Structural Concrete.

**1.6 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings:
  1. Reinforcing steel: Complete shop drawings
  2. Form liner types and locations.
  3. Slab Edge Dimensions.
  4. Locations of slab depressions showing dimensions and depth.
- C. Mill Test Reports:
  1. Reinforcing Steel.
  2. Cement.
- D. Manufacturer's Certificates:
  1. Abrasive aggregate.
  2. Lightweight aggregate for structural concrete.
  3. Air-entraining admixture.
  4. Chemical admixtures, including chloride ion content.
  5. Waterproof paper for curing concrete.

**SECTION 03 30 00**  
**CAST-IN-PLACE CONCRETE**

6. Liquid membrane-forming compounds for curing concrete.
  7. Non-shrinking grout.
  8. Liquid hardener.
  9. Waterstops.
  10. Expansion joint filler.
  11. Adhesive binder.
- E. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology
- F. Test Report for Concrete Mix Designs: Trial mixes including water-cement-fly ash ratio curves, concrete mix ingredients, and admixtures.
- G. Shoring and Reshoring Sequence: Submit for approval a shoring and reshoring sequence for flat slab portions, prepared by a registered Professional Engineer. As a minimum, include timing of form stripping, reshoring, number of floors to be re-shored and timing of re-shore removal to serve as an initial outline of procedures subject to modification as construction progresses. Submit revisions to sequence, whether initiated by Resident Engineer (see FORMWORK) or Contractor.
- H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

**1.7 DELIVERY, STORAGE, AND HANDLING:**

- A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.
- B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement and fly ash in separate suitable bins.
- C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

**SECTION 03 30 00  
CAST-IN-PLACE CONCRETE**

**1.8 PRE-CONCRETE CONFERENCE:**

- A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.
- B. Agenda: Includes but is not limited to:
  - 1. Submittals.
  - 2. Coordination of work.
  - 3. Availability of material.
  - 4. Concrete mix design including admixtures.
  - 5. Methods of placing, finishing, and curing.
  - 6. Finish criteria required to obtain required flatness and levelness.
  - 7. Timing of floor finish measurements.
  - 8. Material inspection and testing.
- C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; lightweight aggregate manufacturer; admixture manufacturers; Resident Engineer; Consulting Engineer; Department of Veterans Affairs retained testing laboratories for concrete testing and finish (F-number) verification.
- D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

**1.9 MOISTURE TESTING (INTERIOR CONCRETE SLABS ON GRADE TO RECEIVE FLOOR FINISHED)**

- A. 45 days after placing interior concrete slabs on grade, moisture testing as follows:
  - 1. Anhydrous Calcium Chloride Test, Quantative Method (RMA Test).
  - 2. Testing to be performed by an approved testing agency and paid for by the Contractor.
  - 3. Testing agency to send results directly to Resident Engineer and Contractor.
  - 4. Provide one test per 1000 square feet or as directed by Resident Engineer.
- B. If slab moisture tests exceed 5.0 lbs Complete Moisture Emission, the slab moisture proofing is considered defective and the entire slab assembly is subject to removal by the Contractor at no cost to the Government.
  - 1. Take the following remediation steps to reduce the slab moisture content:
    - a. If the slab has been double steel troweled, grind face to open up surface.



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- b. Run HVAC system on high heat for 48 hours.
- c. Rent dehumidifiers and run constantly, removing as much moisture as possible.
- 2. Schedule re-testing as required to determine slab moisture content, at Contractor's expense.
- 3. Repeat steps in paragraph (2)a and (2)b above as required to achieve designated moisture content. If slab moisture content fails to be reduced to specified levels after 60 days, remove the slab and reinstall defective moisture barrier.

**1.10 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced.  
Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
  - 117-10 ..... Tolerances for Concrete Construction and Materials
  - 211.1-91(R2009) ..... Selecting Proportions for Normal, Heavyweight, and Mass Concrete
  - 214R-02 ..... Evaluation of Strength Test Results of Concrete
  - 301-10 ..... Structural Concrete
  - 304R-00(R2009) ..... Guide for Measuring, Mixing, Transporting, and Placing Concrete
  - 305R-10 ..... Hot Weather Concreting
  - 306R-10 ..... Cold Weather Concreting
  - 308R-01(R2008) ..... Standard Practice for Curing Concrete
  - 309R-05 ..... Guide for Consolidation of Concrete
  - 315-04 ..... Details and Detailing of Concrete Reinforcement
  - 318-08 ..... Building Code Requirements for Reinforced Concrete and Commentary
  - 347-04 ..... Guide to Formwork for Concrete
- C. American National Standards Institute and American Hardboard Association (ANSI/AHA):
  - A135.4-2004 ..... Basic Hardboard
- D. American Society for Testing and Materials (ASTM):
  - A82/ A82M-07 ..... Steel Wire, Plain, for Concrete Reinforcement

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A185/185M-07 .....	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
A615/ A615M-09.....	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
A653/ A653M-09.....	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
A706/ A706M-09.....	Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
A767/ A767M-09.....	Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
A775/ A775M-07.....	Epoxy-Coated Reinforcing Steel Bars
A820-06 .....	Steel Fibers for Fiber-Reinforced Concrete
A996/ A996M-09.....	Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
C31/ C31M-09 .....	Making and Curing Concrete Test Specimens in the field
C33-08 .....	Concrete Aggregates
C39/ C39M-09 .....	Compressive Strength of Cylindrical Concrete Specimens
C94/ C94M-09 .....	Ready-Mixed Concrete
C143/ C143M-10 .....	Slump of Hydraulic Cement Concrete
C150-09 .....	Portland Cement
C171-07 .....	Sheet Materials for Curing Concrete
C172-08 .....	Sampling Freshly Mixed Concrete
C173-10... .....	Air Content of Freshly Mixed Concrete by the Volumetric Method
C192/ C192M-07 .....	Making and Curing Concrete Test Specimens in the Laboratory
C231-09 .....	Air Content of Freshly Mixed Concrete by the Pressure Method
C260-06 .....	Air-Entraining Admixtures for Concrete
C309-07 .....	Liquid Membrane-Forming Compounds for Curing Concrete

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- C330-09 ..... Lightweight Aggregates for Structural Concrete
- C494/C494M-10 ..... Chemical Admixtures for Concrete
- C618-08 ..... Coal Fly Ash and Raw or Calcined Natural Pozzolan for  
Use as a Mineral Admixture in Concrete
- C666/C666M-03 ..... Resistance of Concrete to Rapid Freezing and Thawing
- C881/C881M-02 ..... Epoxy-Resin-Base Bonding Systems for Concrete
- C1107/1107M-08 ..... Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
- C1315-08 ..... Liquid Membrane-Forming Compounds Having Special  
Properties for Curing and Sealing Concrete
- D6-95(R2006)..... Loss on Heating of Oil and Asphaltic Compounds
- D297-93(R2006)..... Rubber Products-Chemical Analysis
- D1751-04(R2008)..... Preformed Expansion Joint Filler for Concrete Paving and  
Structural Construction (Non-extruding and Resilient  
Bituminous Types)
- D4397-09 ..... Polyethylene Sheeting for Construction, Industrial and  
Agricultural Applications
- E1155-96(R2008) ..... Determining  $F_F$  Floor Flatness and  $F_L$  Floor Levelness  
Numbers
- E. American Welding Society (AWS):  
D1.4/D1.4M-11..... Structural Welding Code - Reinforcing Steel
- F. Concrete Reinforcing Steel Institute (CRSI): Manual of Standard Practice 27<sup>th</sup> Edition.
- G. National Cooperative Highway Research Program (NCHRP):  
Report On..... Concrete Sealers for the Protection of Bridge Structures
- H. U. S. Department of Commerce Product Standard (PS):  
PS 1..... Construction and Industrial Plywood  
PS 20..... American Softwood Lumber
- I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:  
CRD C513..... Rubber Waterstops  
CRD C572..... Polyvinyl Chloride Waterstops

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**PART 2 - PRODUCTS:**

**2.1 FORMS:**

- A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.
- C. Metal for Concrete Rib-Type Construction: Steel (removal type) of suitable weight and form to provide required rigidity.
- D. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.
- E. Corrugated Fiberboard Void Boxes: Double faced, completely impregnated with paraffin and laminated with moisture resistant adhesive, size as shown. Design forms to support not less than 48 KPa (1000 psf) and not lose more than 15 percent of their original strength after being completely submerged in water for 24 hours and then air dried.
- F. Form Lining:
  - 1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)
  - 2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.
  - 3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.
- G. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

**2.2 MATERIALS:**

- A. Portland Cement: ASTM C150 Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalies, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33.

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1. Size 67 or Size 467 may be used for footings and walls over 300 mm (12 inches) thick.
2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.

D. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150  $\mu$ m (No. 100) sieve.

E. Mixing Water: Fresh, clean, and potable.

F. Admixtures:

1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
5. Air Entraining Admixture: ASTM C260.
6. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
7. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.

G. Moisture Barrier:

1. Vapor Barrier: Fortifiber Corp. "Moistop" Ultra 10 a polyolefin film or equal. 10 mils. Minimum thickness. Water vapor permeance: 0.02 perms.
2. Use manufacturer's 2 inch wide sealing tape at all laps.
3. Meet ASTM E1745-97, Class A.

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- H. Reinforcing Steel: ASTM A615, or ASTM A616, or ASTM A617 deformed, grade as shown.
- I. Welded Wire Fabric: ASTM A185.
- J. Reinforcing Bars to be Welded: ASTM A706.
- K. Welded Wire Fabric: ASTM A185.
- N. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- O. Expansion Joint Filler: ASTM D1751.
- P. Sheet Materials for Curing Concrete: ASTM C171.
- Q. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- R. Abrasive Aggregate: Aluminum oxide grains or emery grits.
- S. Moisture Vapor Emissions & Alkalinity Control Sealer: 100% active colorless aqueous silicate solution concrete surface treatment applied the day of the concrete pour in lieu of other curing methods for all concrete slabs receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays .
1. ASTM C1315 Type 1 Class A, and ASTM C309 Type 1 Class A, penetrating product to have no less than 34% solid content, leaving no sheen, volatile organic compound (VOC) content rating as required to suite regulatory requirements. The product shall have at least a five (5) year documented history in controlling moisture vapor emission from damaging floor covering, compatible with all finish materials.
  2. MVE 15-Year Warranty:
    - a. When a floor covering is installed on a below grade, on grade, or above grade concrete slab treated with Moisture Vapor Emissions & Alkalinity Control Sealer according to manufacturer's instruction, sealer manufacturer shall warrant the floor covering system against failure due to moisture vapor migration or moisture-born contaminates for a period of fifteen (15) years from the date of original installation. The warranty shall cover all labor and materials needed to

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replace all floor covering that fails due to moisture vapor emission & moisture born contaminates.

T. Penetrating Sealer: For use on parking garage ramps and decks. High penetration silane sealer providing minimum 95 percent screening per National Cooperative Highway Research Program (NCHRP) No. 244 standards for chloride ion penetration resistance. Requires moist(non-membrane)curing of slab.

U. Non-Shrink Grout:

1. ASTM C1107, pre-mixed, produce a compressive strength of at least 17 MPa (2400 psi) at two days and minimum compressive strength of 48 MPa (7000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.
2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

V. Adhesive Binder: ASTM C881.

W. Polyvinyl Chloride Waterstop: CRD C572.

X. Rubber Waterstops: CRD C513.

Y. Bentonite Water Stop: Flexible strip of bentonite 25 mm x 20 mm (1 inch by 3/4 inch), weighing 8.7 kg/m (5.85 lbs. per foot) composed of Butyl Rubber Hydrocarbon (ASTM D297), Bentonite (SS-S-210-A) and Volatile Matter (ASTM D6).

Z. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).

AA. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 0.9 kg/m<sup>3</sup> (1.5 lb. per cubic yard). Product shall have a UL rating.

BB. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.

CC. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.

DD. Architectural Concrete: For areas designated as architectural concrete on the Contract Documents, use colored cements and specially selected aggregates as necessary to

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produce a concrete of a color and finish which exactly matches the designated sample panel.

**2.3 CONCRETE MIXES:**

- A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
  2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, fly ash, admixtures, weight of fine and coarse aggregate per m<sup>3</sup> (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement-fly ash ratio, shrinkage test, and consistency of each cylinder in terms of slump.
  3. Prepare a curve showing relationship between water-cement-fly ash ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
  4. If the field experience method is used, submit complete standard deviation analysis.
- B. Fly Ash Testing: Submit certificate verifying conformance with specifications initially with mix design and for each truck load of fly ash delivered from source. Notify Resident Engineer immediately when change in source is anticipated. Prior to beginning trial mixes submit to the Resident Engineer the following representative samples of material to be used, properly identified source and project description and number, type of testing (complete chemical and physical), suitably packaged for shipment, and addressed as specified. Allow 60 calendar days for test results after submittal of sample.
1. Fly ash - 2.25 kg (five pounds).
  2. Portland cement - 3.5 kg (8 pounds):
    - a. Address -Waterways Experiment Station (WES)
    - b. 3909 Halls Ferry Road
    - c. Vicksburg, MS 39180-6199
    - d. ATTN: Engineering Materials Group



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- C. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Resident Engineer or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement and fly ash, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. Resident Engineer may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and fly ash and approval of design mix.
- D. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Fly ash may be substituted for up to 20 percent of the minimum cement factor at option of Contractor. Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Use Fly Ash as an admixture with 20% replacement by weight in all structural concrete work. Increase this replacement to 40% for mass concrete, and reduce it to 10% for drilled piers and caissons. Fly ash shall continue to not be allowed in architectural concrete.

**TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE**

Concrete Strength		Non-Air-Entrained	Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio
35 (5000) <sup>1,2</sup>	375 (630)	0.45	385 (650)	0.40
30 (4000) <sup>1,2</sup>	325 (550)	0.55	340 (570)	0.50
25 (3000) <sup>1,2</sup>	280 (470)	0.65	290 (490)	0.55

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c.
2. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
3. Determined by Laboratory in accordance with ACI 211.1 for normal concrete.

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- E. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

**TABLE II - MAXIMUM SLUMP, MM (INCHES)\***

Type of Construction	Normal Weight Concrete
Reinforced Footings and Grade Beams	75mm (3 inches)
Slabs, Reinforced Walls, Concrete over metal deck, and Concrete Pedestals	100 mm (4 inches)

- F. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 225 mm (9 inches). The concrete shall arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches). This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.
- G. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Determine air content by either ASTM C173 or ASTM C231.

**TABLE III - TOTAL AIR CONTENT  
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

Nominal Maximum Size of Coarse Aggregate, mm (Inches)	Total Air Content Percentage by Volume
10 mm (3/8 in)	6 to 10
13 mm (1/2 in)	5 to 9
20 mm (3/4 in)	4 to 8
25 mm (1 in)	3-1/2 to 6-1/2
40 mm (1 1/2 in)	3 to 6

- H. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified

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minimum 28-day compressive strength for concrete type specified made with standard Portland cement.

- I. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).
- J. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. Air content as shown in Table III.
- K. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, Resident Engineer may require any one or any combination of the following corrective actions, at no additional cost to the Government:
  - 1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
  - 2. Require additional curing and protection.
  - 3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, Resident Engineer may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
  - 4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, Resident Engineer may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.

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5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the Resident Engineer.

**2.4 BATCHING AND MIXING:**

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by Resident Engineer. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 38°C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
-1.1 degrees to 4.4 degrees C (30 degrees to 40 degrees F)	15.6 degrees C (60 degrees F.)
-17 degrees C to -1.1 degrees C (0 degrees to 30 degrees F.)	21 degrees C (70 degrees F.)

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the Resident Engineer for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to produce concrete of required quality. Representative shall assist and advise Resident Engineer in establishing and maintaining these controls.
- B. Ready-mixed: May be plant-mixed or transit-mixed.
  1. Plant-mixed concrete: Plant equipped for accurate proportioning and mixing and have sufficient capacity and transportation facilities to deliver concrete at rate required.
    - a. Concrete shall have initial mixing at plant not less than one minute for mixer capacity of 0.8 m<sup>3</sup> (one cubic yard) or less,

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increasing 15 seconds for each additional cubic yard or less, after materials are in mixer.

- b. Maximum time elapsing between discharge of concrete from mixer to its final position in structure is 1-1/2 hours or 300 revolutions of drum.
  - c. Transportation of concrete from plant to job shall be in agitator trucks or transit mixers operated at agitation speed until concrete is discharged.
  - d. Capacity of truck mixer or of truck agitator in accordance with manufacturer's rating.
  - e. Maximum volume of mixed concrete carried is 80 percent of gross volume of drum or container. Minimum agitating speed is two revolutions per minute. Maximum agitating speed is six revolutions per minute of drum or mixing blade.
2. Transit-mixed concrete: Batch and discharge materials into truck mixers capable of transporting and mixing separate ingredients into thoroughly mixed and uniform mass while in transit.
- a. Quality and characteristics of mix conform to requirements specified.
  - b. Flush water not permitted in mixing water.
  - c. Deliver concrete to site and complete placement in final position within 1-1/2 hours after introduction of mixing water or cement.
  - d. Begin mixing operation within 30 minutes after introduction of cement.
  - e. Minimum number of revolutions of mixer is four revolutions of drum per minute and a maximum peripheral velocity of 70 m (225 feet) per minute.
  - f. Mix concrete for not less than 70 nor more than 100 revolutions of drum at rate of rotation designated by manufacturer of equipment at mixing speed.

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- g. Additional mixing shall not exceed 200 revolutions at agitation speed designated by manufacturer of equipment. Agitating speed for transit mixer shall be not less than two nor more than six revolutions per minute.
- h. Operate truck mixers within limits of capacity and speed or rotation designated by manufacturer.
- i. Equip transit mixer with a device for recording number of revolutions made by drum.

**2.5 HARDENING COMPOUNDS:**

A. Heavy Duty Type:

- 1. Type: Dry Shake Quartz
- 2. Illuminating Engineers Society LM-44 Light Reflectance: 60%.
- 3. Maximum Abrasion Resistance under National Bureau of Standards Abrasion Machine for 10 Minutes: 0.016 inches.
- 4. Minimum Hardness measured on Mohs Hardness Scale: 6.75.
- 5. Application Rate: 1-1/2 psf of surface.
- 6. Delivery Condition: Factory proportioned, premixed, and delivered in Moisture-resistant containers.
- 7. Extent of Work: See Room Finish Schedule.

B. Design Basis: Master Builders Maximent 60.

**PART 3 - EXECUTION**

**3.1 FORMWORK:**

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores. Chamfer exposed edges and external corners 25 mm (1 inch), unless otherwise shown.
  - 1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and Resident Engineer approves their reuse.
  - 2. Provide forms for concrete footings unless Resident Engineer determines forms are not necessary.

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3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.
- B. Treating and Wetting: Treat or wet contact forms as follows:
  1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
  2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
  3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than  $1/270$  of free span of member.
- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- E. Lined Forms: All exposed concrete walls (to the exterior of building) are to be lined with the form liner specified in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.
- F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage. Use manufacturer's recommended release agent.
- G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.

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1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
  2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.
- H. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.
1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
  2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
  3. Do not install sleeves in beams, joists or columns except where shown or permitted by Resident Engineer. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the Resident Engineer, and require no structural changes, at no additional cost to the Government.
  4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
  5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.
- I. Construction Tolerances:
1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances.



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Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.

2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

**3.2 PLACING REINFORCEMENT:**

- A. General: Details of concrete reinforcement in accordance with ACI 318 and ACI 315, unless otherwise shown.
- B. Placing: Place reinforcement conforming to CRSI MSP1, unless otherwise shown.
  1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 315. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.
  2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.
- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
  1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
  2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength (fy) for the bars.

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- Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
- a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.
  - b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.
  - c. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by Resident Engineer.
3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength ( $f_y$ ) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
- a. Initial qualification: In the presence of Resident Engineer, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will perform load test.
  - b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs retained testing laboratory will perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by Resident Engineer.
- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

**3.3 VAPOR BARRIER:**

- A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.
  1. Place 100 mm (4 inches) of fine granular fill over the vapor barrier to act as a blotter for concrete slab.

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2. Vapor barrier joints lapped 150 mm (6 inches) and sealed with compatible waterproof pressure-sensitive tape.
3. Patch punctures and tears.

**3.4 MOISTURE VAPOR EMISSIONS & ALKALINITY CONTROL SEALER:**

- A. Sealer is applied on the day of the concrete pour or as soon as harsh weather permits, prior to any other chemical treatments for concrete slabs either on grade, below grade or above grade receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays.
- B. Manufacturer's representative will be on the site the day of concrete pour to install or train its application and document. He shall return on every application thereafter to verify that proper procedures are followed.
  1. Apply Sealer to concrete slabs as soon as final finishing operations are complete and the concrete has hardened sufficiently to sustain floor traffic without damage.
  2. Spray apply Sealer at the rate of 20 m<sup>2</sup> (200 square feet) per gallon. Lightly broom product evenly over the substrate and product has completely penetrated the surface.
  3. If within two (2) hours after initial application areas are subjected to heavy rainfall and puddling occurs, reapply Sealer product to these areas as soon as weather condition permits.

**3.5 CONSTRUCTION JOINTS:**

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by Resident Engineer.
- B. Locate construction joints in suspended floors near midpoint of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.
- C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.

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- D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.
- E. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

**3.6 EXPANSION JOINTS:**

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.
- B. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

**3.7 PLACING CONCRETE:**

- A. Preparation:
  - 1. Remove hardened concrete, wood chips, shavings and other debris from forms.
  - 2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
  - 3. Have forms and reinforcement inspected and approved by Resident Engineer before depositing concrete.
  - 4. Provide runways for wheeling equipment to convey concrete to point of deposit.  
Keep equipment on runways which are not supported by or bear on reinforcement.  
Provide similar runways for protection of vapor barrier on coarse fill.
- B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.
  - 1. Preparing surface for applied topping:
    - a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
    - b. Broom clean and keep base slab wet for at least four hours before topping is applied.
    - c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick

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paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

- C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete subject to approval of Resident Engineer.
- D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.
1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
  2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
  3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
  4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
  5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after it's initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
  6. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.
  7. Concrete on metal deck:

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- a. Concrete on metal deck shall be class and minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.
  1. The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.
- E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.
  1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
  2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

**3.8 HOT WEATHER:**

Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer. When temperature is 24°C (75 degrees Fahrenheit) and rising with a low humidity that is not rising, obtain approval by Resident Engineer and clearance as to procedures of placing concrete. Maximum temperature of concrete when being placed is 38°C (100 degrees Fahrenheit). Cool water, cement, and aggregate to a temperature that will assure that placing temperature of concrete does not exceed 38°C (100 degrees Fahrenheit). Dampen forms, subgrade, and reinforcing steel and protect from sun and wind. Take special care in timing and execution of curing methods.

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Take protective measures as quickly as concrete hardening and finishing operation will allow.

**3.9 COLD WEATHER:**

Follow the recommendations of ACI 306 or as specified to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Non-corrosive accelerator permitted when temperature is below 4.4°C (40 degrees Fahrenheit) and falling, obtain approval by Resident Engineer and clearance as to procedures of placing concrete. Water and aggregate shall be heated, as required, to a temperature that will assure specified placing temperature of concrete is obtained. Mixed concrete shall have a temperature between 16°C and 21°C (60 and 70 degrees Fahrenheit) and placed temperature not less than 13°C (55 degrees Fahrenheit). Provide suitable means for maintaining concrete at temperature of not less than 10°C (50 degrees Fahrenheit) for a period of 72 hours after placing for normal concrete, and 48 hours for high-early-strength concrete or for as long a time as necessary to assure proper rate of curing. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

**3.10 PROTECTION AND CURING:**

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by Resident Engineer.
  - 1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 10m<sup>2</sup>/L (400 square feet per gallon) on steel troweled surfaces

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- and 7.5m<sup>2</sup>/L (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
  3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

**3.11 REMOVAL OF FORMS:**

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
  1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
  2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.
- B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.
- C. Reshoring: Reshoring is required if superimposed load plus dead load of the floor exceeds the capacity of the floor at the time of loading. Reshoring accomplished in accordance with ACI 347 at no additional cost to the Government.

**3.12 CONCRETE SURFACE PREPARATION:**

- A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.



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- B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 25 mm (1 inch). Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 150 mm (6 inches) surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.
- C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

**3.13 CONCRETE FINISHES:**

- A. Vertical and Overhead Surface Finishes:
1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe trenches, above suspended ceilings, manholes, and other unfinished areas will not require additional finishing.
  2. Interior and exterior exposed areas to be painted: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by Resident Engineer, and by rubbing lightly with a fine abrasive stone or hone. Use

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- ample water during rubbing without working up a lather of mortar or changing texture of concrete.
3. Interior and exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
    - a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
    - b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600  $\mu\text{m}$  (No. 30) sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.
    - c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.
    - d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.
  4. Textured: Finish as specified. Maximum quantity of patched area 0.2 m<sup>2</sup> (2 square feet) in each 93 m<sup>2</sup> (1000 square feet) of textured surface.
- B. Slab Finishes:
1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to Resident Engineer and floor consultant for evaluation and recommendations for subsequent placements.
  2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless Resident Engineer determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off

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- elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.
3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
  4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
  5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
  6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
  7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
  8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.

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9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.
10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by Resident Engineer from sample panel.
11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
  - a. Areas covered with carpeting, or not specified otherwise in b. below:
    - 1) Slab on Grade:
      - a) Specified overall value FF 25/FL 20
      - b) Minimum local value FF 17/FL 15
    - 2) Level suspended slabs (shored until after testing) and topping slabs:
      - a) Specified overall value FF 25/FL 20
      - b) Minimum local value FF 17/FL 15
    - 3) Unshored suspended slabs:
      - a) Specified overall value FF 25
      - b) Minimum local value FF 17
    - 4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
  - b. Areas that will be exposed, receive thin-set tile or resilient flooring, or roof areas designed as future floors:
    - 1) Slab on grade:
      - a) Specified overall value FF 36/FL 20
      - b) Minimum local value FF 24/FL 15

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2) Level suspended slabs (shored until after testing) and topping slabs

- a) Specified overall value                      FF 30/FL 20
- b) Minimum local value                        FF 24/FL 15

3) Unshored suspended slabs:

- a) Specified overall value                      FF 30
- b) Minimum local value                        FF 24

4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.

- c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.
  - d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries may not cross a construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.
12. Measurements
- a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by Resident Engineer, to verify compliance with FF, FL, and other finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Department of Veterans Affairs retained testing laboratory.
  - b. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on

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measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.

13. Acceptance/ Rejection:
  - a. If individual slab section measures less than either of specified minimum local  $F_F/F_L$  numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
  - b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall  $F_F/F_L$  numbers, then whole slab shall be rejected and remedial measures shall be required.
14. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by Resident Engineer, until a slab finish constructed within specified tolerances is accepted.

**3.14 SURFACE TREATMENTS:**

- A. Use on exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish.
- B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.
- C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Broadcast aggregate uniformly over concrete surface at rate of application of 8% per 1/10th m<sup>2</sup> (7.5 percent per square foot) of area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.
- D. Hardener Application
  1. Follow Manufacturer's instructions.
  2. Heavy Duty Hardener:
    - a. Immediately following floating of Slab, apply 2/3 of total Hardener, starting adjacent to Forms and other Areas where Moisture will be lost first.

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- b. Using Finishing Machine, float Concrete sufficiently to bring Moisture from Slab through Hardener.
- c. Apply remaining 1/3 of Hardener, and finish in same manner as above.
- d. If time and setting characteristics will allow, further compact Concrete with third floating.
- e. Do not add Water to Concrete surface.
- f. Complete troweling as specified above.
- g. Applicator must be Manufacturer-approved, and under Manufacturer's direct on-site supervision.

**3.15 APPLIED TOPPING:**

- A. Separate concrete topping on floor base slab of thickness and strength shown. Topping mix shall have a maximum slump of 200 mm (8 inches) for concrete containing a high-range water-reducing admixture (superplasticizer) and 100 mm (4 inches) for conventional mix. Neatly bevel or slope at door openings and at slabs adjoining spaces not receiving an applied finish.
- B. Placing: Place continuously until entire section is complete, struck off with straightedge, leveled with a highway straightedge or highway bull float, floated and troweled by machine to a hard dense finish. Slope to floor drains as required. Do not start floating until free water has disappeared and no water sheen is visible. Allow drying of surface moisture naturally. Do not hasten by "dusting" with cement or sand.

**3.16 RESURFACING FLOORS:**

Remove existing flooring areas to receive resurfacing to expose existing structural slab and extend not less than 25 mm (1 inch) below new finished floor level. Prepare exposed structural slab surface by roughening, broom cleaning, and dampening. Apply specified bonding grout. Place topping while the bonding grout is still tacky.

**3.17 RETAINING WALLS:**

- A. Use air-entrained concrete.
- B. Expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves installed and constructed as shown.
- C. Exposed surfaces use form liner as specified in Part 2 of this specification.
- D. Place porous backfill as shown.

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**3.18 PRECAST CONCRETE ITEMS:**

Precast concrete items, not specified elsewhere. Cast using 25 MPa (3000 psi) air-entrained concrete to shapes and dimensions shown. Finish to match corresponding adjacent concrete surfaces. Reinforce with steel for safe handling and erection.

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**SECTION 03 45 00**  
**PRECAST ARCHITECTURAL CONCRETE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section includes the performance criteria, materials, production, and erection of architectural precast concrete header and sill units. The work performed under this section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the architectural precast concrete work shown on the contract drawings.

**1.2 RELATED WORK**

- A. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Mortar: Section 04 05 13, MASONRY MORTARING Section 04 05 16, MASONRY GROUTING
- C. Masonry Facing: Section 04 20 00, UNIT MASONRY.
- D. Sealants and Caulking: Section 07 92 00, JOINT SEALANTS.
- E. Size, type and color of aggregate for exposed aggregate finish and matrix color: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 QUALITY ASSURANCE**

- A. Fabricator Qualifications: A firm that complies with PCI MNL 117 and the following requirements and is experienced in producing units similar to those indicated for this Project and with a record of successful in-service performance:
  - 1. Assumes responsibility for engineering units to comply with performance requirements. A Comprehensive Engineering Analysis shall be performed by a qualified professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.
  - 2. Has sufficient production capacity to produce required units without delaying the work.
- B. Erector Qualifications:
  - 1. A precast concrete erector Qualified by the Precast/Prestressed Concrete Institute (PCI) prior to beginning work at the project site. Submit a current Certificate of Compliance furnished by PCI designating qualification in Category A (Architectural Systems) for non-load-bearing members
  - 2. An erector with a minimum of 2 years of experience who has completed architectural precast concrete work similar in material, design, and extent to that indicated for this Project.
- C. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117.
- D. Sample Panels: After sample approval and before fabricating units, produce a minimum of two sample panels in size for review by Resident Engineer. Incorporate full scale details of architectural features, finishes, textures, and transitions in the sample panels. Approved sample panel may be used for mockup and range sample.
  - 1. Locate panels where indicated or, if not indicated, as directed by Resident Engineer.
  - 2. Demolish and remove sample panels only when directed.

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PRECAST ARCHITECTURAL CONCRETE**

**1.3 QUALITY ASSURANCE (CONT)**

- E. Mockups: After sample approval but before production of units, construct full sized mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Mockup to be representative of the finished work in all respects including glass, aluminum framing, sealants and architectural precast concrete complete with all anchors, connections, flashings, and joint fillers as accepted on the final shop drawings. Build mockups to comply with the following requirements, using materials indicated for the completed work:
  - 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Resident Engineer.
  - 2. Notify Resident Engineer in advance of dates and times when mockups will be constructed.
  - 3. Obtain Resident Engineer's approval of mockups before starting fabrication.
  - 4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 5. Demolish and remove mockups when directed.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01, GENERAL REQUIREMENTS.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Provide units and connections capable of withstanding: the design criteria specified on the drawings, self weights and weights of materials supported or attached, for the conditions indicated.
  - 1. Design Standards: Comply with ACI 318 (ACI 318M) and the design recommendations of PCI MNL 120, applicable to types of units indicated.
  - 2. Limit deflection of precast members as follows:
    - Vertical live load –  $\text{Span} / 360$ .
    - Wind load – Floor to floor height times 0.0025.
  - 3. Design for handling, transportation and erection stresses.
- B. Design framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live load deflection, shrinkage and creep of primary building structure, and other building movements.
- C. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 27 deg C (80 deg F) Use other values, greater or smaller, whenever justified by climatic conditions at the project site.

**1.5 SUBMITTALS**

- A. Design Mixes: For each concrete mix along with compressive strength and water-absorption tests.
- B. Shop (Erection) Drawings: Detail fabrication and installation of units.
  - 1. Indicate member locations with distinctive marks that match marks placed on the panels. Provide plans, elevations, dimensions, corner details, shapes, cross sections and relationships to adjacent materials.
  - 2. Indicate aesthetic intent including joints, reveals, and extent and
  - 3. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, and connections.

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PRECAST ARCHITECTURAL CONCRETE**

**1.5 SUBMITTALS (CONT)**

4. Indicate locations, tolerances and details of anchorage devices to be embedded in or attached to structure or other construction.
5. Design Modifications:  
If design modifications are necessary to meet the performance requirements and field conditions, submit design calculations and drawings. Do not adversely affect the appearance, durability or strength of units when modifying details or materials and maintain the general design concept.
- C. Comprehensive Engineering Analysis: Provide calculations signed and sealed by the qualified professional engineer responsible for the product design. Show governing panel types, connections, and types of reinforcement, including special reinforcement. Indicate design criteria and loads. Indicate the location, type, magnitude and direction of all imposed loadings from the precast system to the building structural frame.

**1.6 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Product handling requirements of PCI MNL 117 shall be followed at the plant and project site.
- B. Deliver all units to the project site in such quantities and at such times to assure compliance with the agreed project schedule and proper setting sequence so as to limit unloading units temporarily on the ground.
- C. Lift and support units only at designated points shown on the Shop Drawings.
- D. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

**1.7 WARRANTY**

- A. Warranty of precast concrete work, including anchorage, joint treatment and related components to be free from defects in materials and workmanship, including cracking and spalling.
- B. After erection, completed work will be weathertight, subject to terms of Article "Warranty of Construction" FAR clause 52.246-21, except warranty period is extended to five years.

**1.8 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A27/A27M-10 .....Steel Castings, Carbon, for General Application
  - A36/A36M-08 .....Carbon Structural Steel
  - A82-07 .....Steel Wire, Plain, for Concrete Reinforcement
  - A108-07 .....Steel Bar, Carbon and Alloy, Cold-Finished
  - A184/A184M-06 .....Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
  - A185-07 .....Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
  - A276-10 .....Stainless Steel Bars and Shapes
  - A283/A283M-03(R2007)..Low and Intermediate Tensile Strength Carbon Steel Plates
  - A307-10 .....Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

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**1.8 APPLICABLE PUBLICATIONS (CONT)**

A325/ A325M-10 .....	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A416/ A416M-10 .....	Steel strand, Uncoated Seven-Wire for Prestressed Concrete
A490/ A490M-10 .....	Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
A496-07 .....	Steel Wire, Deformed, for Concrete Reinforcement
A497-07 .....	Steel Welded Wire Reinforcement, Deformed, for Concrete
A500-10 .....	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A563/ A563M-07 .....	Carbon and Alloy Steel Nuts
A615/ A615M-09 .....	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
A675/ A675M-03(R2009) ..	Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
A934/ A934M-07 .....	Epoxy-Coated Prefabricated Steel Reinforcing Bars
B633-07 .....	Electrodeposited Coatings of Zinc on Iron and Steel
C33-11 .....	Concrete Aggregates
C40-04 .....	Organic Impurities in Fine Aggregate for Concrete
C150-09 .....	Portland Cement
C260-10 .....	Air-Entraining Admixtures for Concrete
C330-09 .....	Lightweight Aggregates for Structural Concrete
C494/ C494M-10 .....	Chemical Admixtures for Concrete
C618-08 .....	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
C881/ C881M-10 .....	for Epoxy-Resin-Base Bonding Systems for Concrete
C979-10 .....	Pigments for Integrally Colored Concrete
C1017/ C1017M-07 .....	Chemical Admixtures for Use in Producing Flowing Concrete
C1107-08 .....	Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
C1218/ C1218M-99(R2008)	Test Method for Water-Soluble Chloride in Mortar and Concrete
C1240-10 .....	Silica Fume Used in Cementitious Mixtures
D412-06 .....	Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
D2240-05(R2010) .....	Test Method for Rubber Property – Durometer Hardness
F436/ F436M-10 .....	Hardened Steel Washers
F568M-07 .....	Carbon and Alloy Steel Externally Threaded Metric Fasteners
F593-02(R2008) .....	Stainless Steel Bolts, Hex Cap Screws, and Studs
F844-07 .....	Washers, Steel, Plain (Flat), Unhardened for General Use
C. American Concrete Institute (ACI):	
ACI 318-11 .....	Building Code Requirements for Structural Concrete
E. Precast/Prestressed Concrete Institute (PCI):	
MNL-117-96 .....	Quality Control for Plants and Production of Architectural Precast Concrete Products
MNL-120-04 .....	Design Handbook – Precast and Prestressed Concrete
MNL-124-08 .....	Design for Fire Resistance of Precast Prestressed Concrete.

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**1.8 APPLICABLE PUBLICATIONS (CONT)**

- MNL-127-99.....Erector's Manual - Standards and Guidelines for the Erection of Precast Concrete Products
- MNL-135-00.....Tolerance Manual for Precast and Prestressed Concrete Construction
- TR-6-03 .....Interim Guidelines for the Use of Self-Consolidating Concrete
- F. Military Specifications (MIL. Spec):
- MIL-C882E-89 .....Cloth, Duck, Cotton or Cotton-Polyester Blend Synthetic Rubber, Impregnated, and Laminated, Oil Resistant.
- G. Structural Steel Painting Council (SSPC):
- SSPC-Paint 20 (2002) .....Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic).

**PART 2 - PRODUCTS**

**2.1 MOLD MATERIALS**

- A. Molds: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; non-reactive with concrete and suitable for producing required finishes:
1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
- B. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Provide solid backing and form supports to ensure that form liners remain in place during concrete placement. Use with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

**2.2 REINFORCING MATERIALS**

- A. Reinforcing Steel: ASTM A615/ A615M, Grade 60 (Grade 420), deformed.
- B. Weldable Reinforcing Bars: ASTM A706/ A706M, deformed.
- a. Plain-Steel Welded Wire Reinforcement: ASTM A185, fabricated from // as-drawn // galvanized and chromate wash treated // steel wire into flat sheets.
  - b. Deformed-Steel Welded Wire Reinforcement: ASTM A497, flat sheet.
- C. Prestressing Strand: ASTM A416/ A416M, Grade 270 (Grade 1860), uncoated, 7-wire, low-relaxation strand.
- D. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

**2.3 CONCRETE MATERIALS**

- A. Portland Cement: ASTM C150, Type I or III.
1. For surfaces exposed to view in finished structure, use white , same type, brand, and mill source throughout the precast concrete production.
  2. Standard gray Portland cement may be used for non-exposed backup concrete.
- B. Supplementary Cementitious Materials for unexposed surfaces (backup concrete) only.
1. Fly Ash Admixture: ASTM C618, Class C or F with maximum loss on ignition of 3 percent.

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PRECAST ARCHITECTURAL CONCRETE**

**2.3 CONCRETE MATERIALS (CONT)**

2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33, with coarse aggregates complying with Class 5S. Provide and stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for entire project.
  1. Face-Mix Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
    - a. Gradation: Uniformly graded
    - b. Hard durable quartz aggregate carefully graded from coarse to fine in proportions required to match approved samples.
  2. Face-Mix Fine Aggregates: Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by Resident Engineer.
    - a. Test sand for color value in accordance with ASTM C40. Sand producing darker than specified color standard is unacceptable.
    - b. Clean washed white sand.
    - c. Special fine aggregate produced by crushing exposed coarse aggregate used for finish specified.
- D. Lightweight Coarse Aggregate: Except as modified by PCI MNL 117, ASTM C 330, with absorption less than 11 percent and free from expanded clay.
- E. Unexposed Surface (Backup) Concrete Aggregates: ASTM C33 or C330 .
- F. Admixtures: Admixtures containing calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture are not permitted.
  1. Coloring Admixture: ASTM C979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable and non-fading.
  2. Air Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
  3. Water-Reducing Admixture: ASTM C494/C494M, Type A.
  4. Retarding Admixture: ASTM C494/C494M, Type B.
  5. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
  6. Plasticizing Admixture for Flowable Concrete: ASTM C1017/C1017M.
- G. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

**2.4 STEEL CONNECTION MATERIALS**

- A. Carbon-Steel Shapes and Plates: ASTM A36/A36M except silicon (Si) content in the range of 0 to 0.03% or 0.15 to 0.25% for materials to be galvanized. Steel with chemistry conforming to the formula  $Si + 2.5P \leq 0.09$  is also acceptable.
- B. Carbon-Steel Headed Studs: ASTM A108, Grades 1018 through 1020, cold finished and bearing the minimum mechanical properties for studs as indicated under PCI MNL 117, Table 3.2.3.; AWS D1.1, Type A or B, with arc shields.
- C. Carbon-Steel Plate: ASTM A283/A283M.
- D. Carbon-Steel Castings: ASTM A27/A27M, Grade U-60-30 (Grade 415-205).
- E. Carbon-Steel Structural Tubing: ASTM A500, Grade B.
- F. Deformed-Steel Wire or Bar Anchors: ASTM A496 or ASTM A706/A706M.
- G. Carbon-Steel Bolts and Studs: ASTM A307, Grade A (ASTM F568M, Property Class 4.6) carbon-steel, hex-head bolts and studs; carbon-steel nuts (ASTM A563/A563M, Grade A); and flat, unhardened steel washers (ASTM F844).

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PRECAST ARCHITECTURAL CONCRETE**

**2.4 STEEL CONNECTION MATERIALS (CONT)**

- H. Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A123/ A123M, after fabrication, or ASTM A153/ A153M, as applicable
  - 1. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with SSPC-Paint 20.
- I. Welding Electrodes: Comply with AWS standards.

**2.5 STAINLESS-STEEL CONNECTION MATERIALS**

- A. Stainless-Steel Plate: ASTM A666, Type 304, of grade suitable for application.
- B. Stainless-Steel Bolts and Studs: ASTM F593, alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless steel washers. Lubricate threaded parts of stainless steel bolts with an anti-seize thread lubricant during assembly.
- C. Stainless-Steel Headed Studs: ASTM A276 and bearing the minimum mechanical properties for studs as indicated under PCI MNL 117, Table 3.2.3.

**2.6 BEARING PADS AND OTHER ACCESSORIES**

- A. Provide bearing pads for units as follows:
  - 1. Elastomeric Pads: AASHTO M251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer according to ASTM D2240, minimum tensile strength 15.5 MPa (2250 psi) per ASTM D412.
  - 2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer according to ASTM D2240. Capable of supporting a compressive stress of 20.7 MPa (3000 psi) with no cracking, splitting or delaminating in the internal portions of the pad. Test one specimen for each 200 pads used in the project.
  - 3. Frictionless Pads: Tetrafluoroethylene (teflon), glass-fiber reinforced, bonded to stainless or mild-steel plates, of type required for in-service stress.
- B. Reglets: Stainless steel, ASTM A167, Type 302 felt or fiber filled or cover face opening of slots.
- C. Vents and Weeps: Polyvinyl chloride plastic tubing, 9.5 mm (3/8-inch) inside diameter.
- D. Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install units.

**2.7 GROUT MATERIALS**

- A. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, Grade A for drypack and Grades B and C for flowable grout and of a consistency suitable for application within a 30-minute working time.

**2.8 CONCRETE MIXES**

- A. Prepare design mixes to match Resident Engineer's sample for each type of concrete required.
  - 1. Limit use of fly ash and granulated blast-furnace slag to 20 percent replacement of Portland cement by weight

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PRECAST ARCHITECTURAL CONCRETE**

**2.8 CONCRETE MIXES (CONT)**

- B. Design mixes shall be prepared by a qualified independent testing agency or by qualified precast plant personnel at fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested in accordance with ASTM C1218/C1218M.
- D. Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on project, to provide normal-weight concrete with the following properties:
  - 1. Compressive Strength (28 Days): 34.5 MPa (5000 psi).
  - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
  - 3. Release Strength at Transfer of Prestress: 24.1 MPa (3500 psi).
- E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- G. When included in design mixes, add other admixtures to concrete mixes according to manufacturer's written instructions.

**2.9 MOLD FABRICATION**

- A. Molds: Accurately construct and maintain molds, mortar tight, within fabrication tolerances and of sufficient strength to withstand pressures due to concrete-placement and vibration operations and temperature changes and for prestressing and detensioning operations.
  - 1. Form joints are not permitted on faces exposed to view in the finished work.
  - 2. Edge and Corner Treatment: Uniformly radiused .
  - 3. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during placing of concrete.
  - 4. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

**2.10 SETTING FACING UNITS**

- A. Place form liner templates accurately to provide grid for brick facings. Provide solid backing and supports to maintain stability of liners while placing bricks and during placing of concrete.
- B. Securely place brick units face down into form liner pockets and place precast concrete backing mix.
- C. Clean faces and joints of brick facing.

**2.11 FABRICATION**

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.  
Weld headed studs and deformed bar anchors used for anchorage.



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**PRECAST ARCHITECTURAL CONCRETE**

**2.11 FABRICATION (CONT)**

- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in units as indicated.
- D. Cast-in openings larger than 250 mm (10 inches) in any dimension. Do not drill or cut openings or reinforcing without approval of Resident Engineer.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabrication, placing, and supporting reinforcement.
  - 1. Place reinforcing steel and prestressing strand to maintain at least 19 mm (3/4 inch) minimum concrete cover. Increase cover requirements for reinforcing steel to 38 mm (1-1/2 inches) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete.
  - 2. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Prestress tendons for units by pretensioning methods. Comply with PCI MNL 117.
  - 1. Protect strand ends and anchorages with bituminous to prevent corrosion and rust spots.
- G. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.
  - 1. At the fabricator's option either of the following mix design/casting techniques may be used:
    - a. A single design mix throughout the entire thickness of panel.
    - b. Design mixes for facing and backup; using cement and aggregates for each type as indicated, for consecutive placement in the mold. Use cement and aggregate specified for facing mix, use cement and aggregate for backup mix complying with criteria specified as selected by the fabricator.
- H. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117.
  - 1. Place backup concrete to ensure bond with face mix concrete.
  - 2. Place self-consolidating concrete without vibration in accordance with PCI TR-6.
- I. Identify pickup points of units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each unit on a surface that will not show in finished structure.
- J. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.
- K. Repair damaged units to meet acceptability requirements of PCI MNL 117 and the Resident Engineer.

**2.12 INSULATED PANEL CASTING**

- A. Cast and screed supported wythe over mold.
- B. Place insulation boards, abutting edges and ends of adjacent boards. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.

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**PRECAST ARCHITECTURAL CONCRETE**  
**2.12 INSULATED PANEL CASTING (CONT)**

- C. Cast and screed top wythe to meet required finish.

**2.13 FABRICATION TOLERANCES**

- A. Fabricate units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
1. Additional Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
    - a. Location of Bearing Surface from End of Member: Plus or Minus 6 mm (1/4 inch).
    - b. Position of Sleeve: Plus or Minus 13 mm (1/2 inch).
    - c. Location of Window Washer Track or Buttons: Plus or Minus 3 mm (1/8 inch).
- B. Fabricate architectural trim units such as sills and lintels with tolerances meeting PCI MNL 135.

**2.14 FINISHES**

- A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight and sharp. Finish exposed-face surfaces of units to match approved design mockups and as follows:
1. PCI's "Architectural Precast Concrete –Color and Texture Selection Guide," of plate numbers indicated.
  2. As-Cast Surface Finish: Provide surfaces free of excessive air voids, sand streaks, and honeycombs.
  3. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections and insulation from acid attack.
- B. Finish exposed top, bottom, surfaces of units to match face-surface finish.
- D. Finish unexposed surfaces of units by float finish.

**2.15 SOURCE QUALITY CONTROL**

- A. Quality-Control Testing: Test and inspect precast concrete according to Section 01 45 29, TESTING LABORATORY SERVICES and PCI MNL 117 requirements respectively. If using self-consolidating concrete also test and inspect according to PCI TR-6.
- B. Testing: If there is evidence that the concrete strength of precast concrete units may be deficient, Precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to PCI MNL 117:
1. Test results will be made in writing on the same day that tests are performed, with copies to Resident Engineer, Contractor, and precast concrete fabricator. Test reports will include the information required in Section TESTING LABORATORY SERVICES and the following:
    - a. Identification mark and type of precast concrete units represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- C. Defective or Damaged Work: Units that do not comply with acceptability requirements, including concrete strength, manufacturing tolerances, and color and texture range are

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**PRECAST ARCHITECTURAL CONCRETE**

**2.15 SOURCE QUALITY CONTROL (CONT)**

unacceptable. Chipped, spalled or cored units may be repaired, if repaired units match the visual mock-up. The Resident Engineer reserves the right to reject any unit if it does not match the accepted samples and visual mock-up. Replace unacceptable units with precast concrete units that comply with requirements.

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Deliver anchorage devices that are embedded in or attached to the building structural frame or foundation before start of such work. Provide locations, setting diagrams, and templates for the proper installation of each anchorage device.
- B. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install units until supporting structural framing has attained minimum allowable design strength or supporting steel or other structure is structurally ready to receive loads from precast .

**3.2 ERECTION**

- A. Erect level, plumb and square within the specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
  - 1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
  - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
  - 3. Remove projecting lifting devices and use sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.
  - 4. Unless otherwise shown provide for uniform joint widths of 19mm (3/4 inch) Insert Width .
- B. Connect units in position by bolting, welding, grouting, or as otherwise indicated on approved Erection Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and/or grouting are completed.
  - 1. Disruption of roof flashing continuity by connections is not permitted; concealment within roof insulation is acceptable.
  - 2. Welding: Comply with applicable requirements for welding.
    - a. Protect units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
    - b. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS.

**SECTION 03 45 00  
PRECAST ARCHITECTURAL CONCRETE**

**3.2 ERECTION (CONT)**

- c. Clean weld affected metal surfaces and apply a minimum 100 µm (0.004 inch) thick coat of galvanized repair paint to galvanized surfaces in conformance with ASTM A780.
  - d. Visually inspect all welds critical to precast connections. Visually check all welds for completion and remove, reweld or repair all defective welds.
- 3. At bolted connections, use lock washers, tack welding, or other acceptable means to prevent loosening of nuts after final adjustment.
  - a. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connection apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.
- 4. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
- C. Attachments: Upon approval of Resident Engineer, precast pre-stressed products may be drilled or "shot" for fasteners or small openings. Provided reinforcing or pre-stressing steel is not damaged or cut.
  - 1. Should spalling occur, repair according to this specification section.
- D. Venting and Weeps: Where precast concrete panels form the outer wythe of cavity wall construction, vent the cavity wall.
  - 1. Use polyvinyl chloride plastic tubing to vent the cavity.
  - 2. Place plastic vent tubes "tilted down and out" in horizontal and vertical joints.
  - 3. Space vent tubes in accordance with shop drawings, but not less than two vents per panel or approximately 1220 mm (4 feet) on centers.
- E. Setting: Where shown, fill joints with cement mortar specified in Section 04 05 13, MASONRY MORTARING Section 04 05 16, MASONRY GROUTING.
  - 1. Clean surfaces forming beds and other joints for precast concrete panels of dust, dirt, and other foreign matter, and wet thoroughly to prevent suction before precast concrete, elements are set.
  - 2. Set precast element level and true to line with uniform joints filled completely with mortar.

Rake out joints 25 mm (1-inch) deep for pointing or sealants.  
Joints required to have only sealant: Kept free of mortar for full depth.
  - 3. Keep exposed faces of precast concrete elements free of mortar.
  - 4. Remove wedges, spacers, or other appliances which are likely to cause staining from joints.
  - 5. Where parging is shown, parge back of elements solid with mortar. Apply parging without skips or holidays.
- F. Pointing: Wash and brush clean, leaving joints free from loose mortar, dust and other foreign material.
  - 1. Carefully point with a slightly concave joint.
  - 2. Mortar for pointing as specified in Section 04 05 13, MASONRY MORTARING Section 04 05 16, MASONRY GROUTING. Use same material and color sand used in

**SECTION 03 45 00  
PRECAST ARCHITECTURAL CONCRETE**

**3.2 ERECTION (CONT)**

fabrication of precast concrete elements when specified in Section 09 06 00, SCHEDULE FOR FINISHES.

- G. Sealing of Joints: Where shown and where required to make work watertight: clean, dry and seal joints between precast concrete elements and between precast elements and adjoining materials as specified in Section 07 92 00, JOINT SEALANTS.

**3.3 ERECTION TOLERANCES**

- A. Erect units level, plumb, square, true, and in alignment without exceeding the erection tolerances of PCI MNL 117, Appendix I.

**3.4 FIELD QUALITY CONTROL**

- A. Refer to Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Testing agency will report test results promptly and in writing to Contractor and Resident Engineer.
- C. Repair or remove and replace work that does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

**3.5 REPAIRS**

- A. Repairs will be permitted provided structural adequacy of units and appearance are not impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 6 m (20 feet).
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780.
- D. Remove and replace damaged units when repairs do not meet requirements.

**3.6 CLEANING**

- A. Clean all surfaces of precast concrete to be exposed to view, as necessary, prior to shipping.
- B. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
  - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
  - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

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**SECTION 04 05 13  
MASONRY MORTARING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Section specifies mortar materials and mixes.

**1.2 RELATED WORK:**

- A. Mortar used in Section:
  - 1. Section 04 05 16, MASONRY GROUTING.
  - 2. Section 04 20 00, UNIT MASONRY.
  - 3. Section 04 72 00, CAST STONE MASONRY.
- B. Mortar Color: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 TESTING LABORATORY-CONTRACTOR RETAINED**

- A. Engage a commercial testing laboratory approved by Resident Engineer to perform tests specified below.
- B. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to Resident Engineer.

**1.4 TESTS**

- A. Test mortar and materials specified.
- B. Testing:
  - 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications.
  - 2. Mortar:
    - a. Test for compressive strength and water retention; ASTM C270.
    - b. Mortar compressive strengths 28 days as follows:  
Type S: Minimum 12400 kPa (1800 psi) at 28 days.
- C. During progress of work, testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES, takes and tests samples as specified in that section. Testing procedures and test methods in ASTM C780.

**1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Laboratory Test Reports:
  - 1. Mortar, each type.
  - 2. Admixtures.

**1.6 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

**SECTION 04 05 13  
MASONRY MORTARING**

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C40-04 ..... Organic Impurities in Fine Aggregates for Concrete
  - C91-05 ..... Masonry Cement
  - C109-08 ..... Compressive Strength of Hydraulic Cement Mortars  
(Using 2-in. or 50-MM Cube Specimens)
  - C144-04 ..... Aggregate for Masonry Mortar
  - C150-09 ..... Portland Cement
  - C207-06 ..... Hydrated Lime for Masonry Purposes
  - C270-10 ..... Mortar for Unit Masonry
  - C979-10 ..... Pigments for Integrally Colored Concrete
  - C1329-05 ..... Mortar Cement

**PART 2 - PRODUCTS**

**2.1 HYDRATED LIME**

- A. ASTM C207, Type S.

**2.2 AGGREGATE FOR MASONRY MORTAR**

- A. ASTM C144 and as follows:
  - 1. Light colored sand for mortar for laying face brick.

**2.3 PORTLAND CEMENT**

- A. ASTM C150, Type I.

**2.4 WATER**

- A. Potable, free of substances that are detrimental to mortar, masonry, and metal.

**2.5 MASONRY MORTAR**

- A. Conform to ASTM C270.
- B. Admixtures:
  - 1. Do not use mortar admixtures, unless approved by Resident Engineer.
  - 2. Do not use antifreeze compounds.
- C. Colored Mortar:
  - 1. Maintain uniform mortar color for exposed work throughout.
  - 2. Match mortar color in approved sample or mock-up.
  - 3. Color of mortar for exposed work to match color of existing mortar unless specified otherwise in section 09 06 00, SCHEDULE FOR FINISHES.
- D. Color Admixtures:
  - 1. Proportion as specified by manufacturer.
  - 2. For color, see Section 09 06 00, SCHEDULE FOR FINISHES.



**SECTION 04 05 13  
MASONRY MORTARING**

**2.6 COLOR ADMIXTURE**

- A. Pigments: ASTM C979.
- B. Use mineral pigments only. Organic pigments are not acceptable.
- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

**PART 3 - EXECUTION**

**3.1 MIXING**

- A. Mix in a mechanically operated mortar mixer.
  - 1. Mix mortar for at least three minutes but not more than five minutes.
- B. Measure ingredients by volume. Measure by the use of a container of known capacity.
- C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.
- D. Mortar that has stiffened because of loss of water through evaporations:
  - 1. Discard mortar that has reached its initial set or has not been used within two hours.

**3.2 MORTAR USE LOCATION**

- A. Use Type M mortar for precast concrete panels
- B. Use Type S mortar for masonry containing vertical reinforcing bars and setting cast stone and engineered reinforced unit masonry work .
- C. For brick veneer over frame back up walls, use Type N portland cement-lime mortar or Type S masonry cement or mortar cement mortar.
- D. Use Type N mortar for other masonry work, except as otherwise specified.

- - - E N D - - -



**SECTION 04 05 16  
MASONRY GROUTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Section specifies grout materials and mixes.

**1.2 RELATED WORK:**

- A. Grout used in Section:
  - 1. Section 03 45 00, PRECAST ARCHITECTURAL CONCRETE.
  - 2. Section 04 20 00, UNIT MASONRY.
  - 3. Section 04 72 00, CAST STONE MASONRY.
- B. Grout Color: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 TESTS:**

- A. Test grout and materials specified.
- F. Testing:
  - 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications
  - 2. Grout:
    - a. Grout compressive strength of 13790 kPa (2000 psi) at 28 days.
  - 3. Sand: Test for deleterious substances, organic impurities, soundness and grading.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA,&SAMPLES.
- B. Laboratory Test Reports:
  - 1. Grout, each type.

**1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:**

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

**1.6 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C40-04 .....Organic Impurities in Fine Aggregates for Concrete
  - C91-05 .....Masonry Cement
  - C150-09 .....Portland Cement
  - C207-06 .....Hydrated Lime for Masonry Purposes
  - C404-07 .....Aggregate for Masonry Grout
  - C476-10 .....Grout for Masonry
  - C979-10 .....Pigments for Integrally Colored Concrete
  - C1019-11 .....Sampling and Testing Grout

**SECTION 04 05 16  
MASONRY GROUTING**

**PART 2 - PRODUCTS**

**2.1 HYDRATED LIME:**

- A. ASTM C207, Type S.

**2.2 AGGREGATE FOR MASONRY GROUT:**

- A. ASTM C404, Size 8.

**2.4 MASONRY CEMENT:**

- A. ASTM C91. Type N, S, or M.

**2.5 PORTLAND CEMENT:**

- A. ASTM C150, Type I.

**2.6 WATER:**

Potable, free of substances that are detrimental to grout, masonry, and metal.

**2.7 GROUT:**

- A. Conform to ASTM C476 except as specified.
- B. Grout type proportioned by volume as follows:
  - 1. Fine Grout:
    - a. Portland cement or blended hydraulic cement: one part.
    - b. Hydrated lime: 0 to 1/10 part.
    - c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
  - 2. Coarse Grout:
    - a. Portland cement or blended hydraulic cement: one part.
    - b. Hydrated lime: 0 to 1/10 part.
    - c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
    - d. Coarse aggregate: one to two times sum of volumes of cement and lime used.
  - 3. Sum of volumes of fine and coarse aggregates: Do not exceed four times sum of volumes of cement and lime used.

**2.8 COLOR ADMIXTURE:**

- A. Pigments: ASTM C979.
- B. Use mineral pigments only. Organic pigments are not acceptable.
- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

**PART 3 - EXECUTION**

**3.1 MIXING:**

- A. Mix in a mechanically operated grout mixer.
  - 1. Mix grout for at least five minutes.

**SECTION 04 05 16  
MASONRY GROUTING**

**3.1 MIXING: (CONT)**

- B. Measure ingredients by volume. Measure by the use of container of known capacity.
- C. Mix water with grout dry ingredients in sufficient amount to bring grout mixture to a pouring consistency.

**3.2 GROUT USE LOCATIONS:**

- A. Use either fine grout or coarse grout for cells of concrete masonry units where the smallest dimension is greater than 50 mm (2 inches).

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**SECTION 04 20 00  
UNIT MASONRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies requirements for construction of masonry unit walls.

**1.2 RELATED WORK**

- A. Mortars and grouts: Section 04 05 13, MASONRY MORTARING, Section 04 05 16, MASONRY GROUTING.
- B. Steel lintels and shelf angles: Section 05 50 00, METAL FABRICATIONS.
- D. Flashing: Section 07 60 00, FLASHING AND SHEET METAL.
- E. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.
- F. Color and texture of masonry units: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples:
  - 1. Face brick, sample panel, (2 inches by 4 inches by 8 inches) showing full color range and texture of bricks, bond, and proposed mortar joints.
  - 2. Concrete masonry units, when exposed in finish work.
- D. Certificates:
  - 1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
  - 2. Indicating that the following items meet specification requirements:
    - a. Face brick.
- E. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.4 SAMPLE PANEL**

- A. Before starting masonry, lay up a sample panel in accordance with Masonry Standards Joint Committee (MSJC) and Brick Industry Association (BIA).
  - 1. Use masonry units from random cubes of units delivered on site.
  - 2. Include reinforcing, ties, and anchors.
  - 3. Include all conditions of assembly including with Precast sill.
- B. Use sample panels approved by Resident Engineer for standard of workmanship and assembly technique of new masonry work.

**SECTION 04 20 00**  
**UNIT MASONRY**

## 1.5 WARRANTY

Warrant exterior masonry walls against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be five years.

## 1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

## 1.6 APPLICABLE PUBLICATIONS (CONT)

- B. American Society for Testing and Materials (ASTM):
  - A615/ A615M-09.....Deformed and Plain Billet-Steel Bars for
  - C90-11 .....Load-Bearing Concrete Masonry Units
  - C216-10 .....Facing Brick (Solid Masonry Units Made From Clay or Shale)
  - C476-10 .....Standard Specification for Grout for Masonry
- C. Masonry Industry Council:
  - Hot and Cold Weather Masonry Construction Manual-98 (R2000).
- D. American Welding Society (AWS):
  - D1.4-11       Structural Welding Code – Reinforcing Steel.
- E. Federal Specifications (FS):
  - FF-S-107C-00 .....Screws, Tapping and Drive
- F. Brick Industry Association - Technical Notes on Brick Construction (BIA):
  - 11-2001 .....Guide Specifications for Brick Masonry, Part I
  - 11A-1988 .....Guide Specifications for Brick Masonry, Part II
  - 11B-1988 .....Guide Specifications for Brick Masonry, Part III Execution
  - 11C-1998 .....Guide Specification for Brick Masonry Engineered Brick Masonry,  
Part IV
  - 11D-1988 .....Guide Specifications for Brick Masonry Engineered Brick Masonry,  
Part IV continued
- G. Masonry Standards Joint Committee; Specifications for Masonry Structures TMS 602-08/ ACI 530.1-08/ ASCE 6-08 (2008 MSJC Book Version TMS-0402-08).

## PART 2 - PRODUCTS

## 2.1 BRICK

- A. Face Brick:
  1. ASTM C216, Grade SW, Type FBS.
  2. Brick when tested in accordance with ASTM C67: Classified slightly efflorescent or better.
  3. Size:
    - a. Modular: 8 x 3 5/8 x 2 inch nominal
  4. Color: Blend of 3 colors compatible with other buildings on VA Campus
  5. Texture: Wire cut
  6. Extent of Use: Exterior Veneer



**SECTION 04 20 00  
UNIT MASONRY**

**2.2 CONCRETE MASONRY UNITS**

- A. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
  - 1. Unit Weight: Normal weight
  - 2. Sizes: Modular 8x8x16
  - 3. Grade N, Type 1 medium weight
  - 4. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
    - a. Split-face Units:
      - 1) Split-faced Units: Rib shapes as shown.
    - b. Standard faced Units:
      - 1) Smooth
  - 5. Minimum compressive strength of 1900 psi

**2.2 REINFORCEMENT:**

- A. Steel Reinforcing Bars: ASTM A615, deformed bars, 420 MPa (Grade 60) for bars No. 10 to No. 57 (No. 3 to No. 18), except as otherwise indicated.
- B. Shop-fabricate reinforcement bars which are shown to be bent or hooked. Do not bend or realign reinforcement after being embedded in hardened grout.

**2.3 ANCHORS, TIES, AND REINFORCEMENT**

- A. Steel Reinforcing Bars: ASTM A615M, deformed bars, grade as shown.
- B. Adjustable Veneer Anchor for Frame Walls:
  - 1. Two piece, adjustable anchor and tie.
  - 2. Anchor and tie may be either type; use only one type throughout.

**2.4 PREFORMED COMPRESSIBLE JOINT FILLER**

- A. Thickness and depth to fill the joint as specified.
- B. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
- C. Non-Combustible Type: ASTM C612, Class 5, 1800 degrees F.

**2.5 ACCESSORIES**

- A. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
- B. Net for Mortar:
  - 1. 90% open weave nylon mesh, 44% recycled material.
  - 2. Moisture management, multiple paths to leave cavity
  - 3. Shaped to prevent mortar droppings from damming.
- C. Masonry Cleaner:
  - 1. Detergent type cleaner selected for each type masonry used.
  - 2. Acid cleaners are not acceptable.
  - 3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.
- D. Fasteners:
  - 1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
  - 2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
  - 3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting

**SECTION 04 20 00  
UNIT MASONRY**

**PART 3 - EXECUTION**

**3.1 JOB CONDITIONS**

- A. Protection:
  - 1. Cover tops of walls with nonstaining waterproof covering, when work is not in progress. Secure to prevent wind blow off.
  - 2. On new work protect base of wall from mud, dirt, mortar droppings, and other materials that will stain face, until final landscaping or other site work is completed.
- B. Cold Weather Protection:
  - 1. Masonry may be laid in freezing weather when methods of protection are utilized.
  - 2. Comply with MSJC and "Hot and Cold Weather Masonry Construction Manual".

**3.2 CONSTRUCTION TOLERANCES**

- A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:
- B. Maximum variation from plumb:
  - 1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
- C. Maximum variation from level:
  - 1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
- D. Maximum variation from linear building lines:
  - 1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
- E. Maximum variation in prepared opening dimensions:
  - 1. Plus 6 mm (1/4 inch).

**3.3 INSTALLATION GENERAL**

- A. Keep finish work free from mortar smears or spatters, and leave neat and clean.
- B. Anchor masonry as specified in Paragraph, ANCHORAGE.
- C. Wall Openings:
  - 1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
  - 2. If items are not available when walls are built, prepare openings for subsequent installation.
- D. Tooling Joints:
  - 1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
  - 2. Tool while mortar is soft enough to be compressed into joints and not raked out.
  - 3. Finish joints in exterior face masonry work with a jointing tool, and provide smooth, water-tight joint to match other buildings unless specified otherwise.
  - 4. Tool Exposed interior joints concave unless specified otherwise.
- E. Lintels:
  - 1. Precast concrete lintels and sills are used at openings. See Drawings
- F. Wall, Furring, and Partition Units:
  - 1. Lay out field units to provide for running bond of walls and partitions, with vertical joints in second course centering on first course units unless specified otherwise.
  - 2. Align head joints of alternate vertical courses.
  - 3. At sides of openings, balance head joints in each course on vertical center lines of openings.
  - 4. Use no piece shorter than 100 mm (4 inches) long.

**SECTION 04 20 00  
UNIT MASONRY**

**3.3 INSTALLATION GENERAL (CONT)**

- 5. Provide a 6 mm (1/4 inch) open joint for caulking between exterior walls and abutting partitions.
- G. Before connecting new masonry with previously laid, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.
  - 1. Masonry may have electrical conduits 25 mm (1 inch) or less in diameter when covered with soaps, or other finishes.
  - 2. Full recess chases after installation of conduit, with mortar and finish flush.
  - 3. When pipes or conduits, or both occur in hollow masonry unit partitions retain at least one web of the hollow masonry units.
- H. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

**3.4 REINFORCEMENT**

- A. Brick veneer over frame backing walls does not require joint reinforcement.
- B. Steel Reinforcing Bars:
  - 1. Install in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for lintels and bond beam horizontal reinforcement.
  - 2. Use grade 60 bars if not specified otherwise.
  - 3. Bond Beams:
    - a. Form Bond beams of load-bearing concrete masonry units filled with ASTM C476 grout and reinforced with 2-#15m (#5) reinforcing steel unless shown otherwise. Do not cut reinforcement.
    - b. Brake bond beams only at expansion joints and at control joints, if shown.

**3.5 BRICK EXPANSION AND CMU CONTROL JOINTS.**

- A. Provide brick expansion (BEJ) and CMU control (CJ) joints where shown on drawings.
- B. Keep joint free of mortar and other debris.
- C. Where joints occur in masonry walls.
  - 1. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on each side of shear key unless otherwise specified.
  - 2. Install filler, backer rod, and sealant on exposed faces.
- D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint.
- E. Interrupt steel joint reinforcement at expansion and control joints unless otherwise shown.
- F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

**3.6 BUILDING EXPANSION AND SEISMIC JOINTS**

- A. Keep joint free of mortar. Remove mortar and other debris.
- B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.

**SECTION 04 20 00  
UNIT MASONRY**

**3.6 BUILDING EXPANSION AND SEISMIC JOINTS (CONT)**

- C. Where joints are on exposed faces, provide depth for backer rod and sealant as specified in Section 07 92 00, JOINT SEALANTS, unless shown otherwise.

**3.7 BRICKWORK**

- A. Lay face brick in accordance with BIA Technical Note 11 series.
- B. Laying:
  - 1. Lay brick in running bond with course of masonry bonded at corners unless shown otherwise.
  - 2. Maintain bond pattern throughout.
  - 3. Do not use brick smaller than half-brick at any angle, corner, break or jamb.
  - 4. Where length of cut brick is greater than one half but less than a whole brick, maintain the vertical joint location of such units.
  - 5. Lay exposed brickwork joints symmetrical about center lines of openings.
  - 6. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.
- C. Joints:
  - 1. Exterior and interior joint widths: Lay for three equal joints in 200 mm (eight inches) vertically, unless shown otherwise.

**3.8 CONCRETE MASONRY UNITS**

- A. Kind and Users:
  - 1. Provide special concrete masonry shapes as required. Use solid concrete masonry units, where full units cannot be used, or where needed for anchorage of accessories.
  - 2. Provide solid load-bearing concrete masonry units or grout the cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
- B. Laying:
  - 1. Lay concrete masonry units with 10 mm (3/8 inch) joints, with a bond overlap of not less than 1/4 of the unit length, except where stack bond is required.
  - 2. Do not wet concrete masonry units before laying.
  - 3. Bond external corners of partitions by overlapping alternate courses.
  - 4. Lay first course in a full mortar bed.
  - 5. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill such voids with mortar or grout.
  - 6. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings not less than 50 mm (2 inches) by 75 mm (3 inches).
  - 8. Do not wedge the masonry against the steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
  - 9. Steel reinforcement in place before grouting.
  - 10. Minimum clear distance between parallel bars: One bar diameter.
  - 11. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacings noted.
  - 12. Reinforcement shall be fully encased by grout or concrete.

**SECTION 04 20 00  
UNIT MASONRY**

**3.8 CONCRETE MASONRY UNITS (CONT)**

13. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.
14. Cavity and joint horizontal reinforcement may be placed as the masonry work progresses.
15. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

**3.9 POINTING**

- A. Fill joints with pointing mortar using rubber float trowel to rub mortar solidly into raked joints.
- B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.
- C. Finish exposed joints in finish work with a jointing tool to provide a smooth concave joint unless specified otherwise.

**3.10 GROUTING**

- A. Preparation:
  1. Clean grout space of mortar droppings before placing grout.
  2. Verify reinforcing bars are in cells of units or between wythes as shown.
- B. Placing:
  1. Place grout by hand bucket, concrete hopper, or grout pump.
  2. Consolidate each lift of grout after free water has disappeared but before plasticity is lost.
  3. Do not slush with mortar or use mortar with grout.
- D. Low Lift Method:
  1. Construct masonry to a height of 1.5 m (5 ft) maximum before grouting.
  2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

**3.11 PLACING REINFORCEMENT**

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 25 mm (1 inch), whichever is greater.
- C. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
- D. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

**3.12 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY**

- A. Do not wet concrete masonry units (CMU).
- B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 10 mm (3/8 inch) joints.
- C. Where solid CMU units are shown, lay with full mortar head and bed joints.

**SECTION 04 20 00  
UNIT MASONRY**

**3.12 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY (CONT)**

**D. Walls:**

1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.
4. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.

**F. Grouting:**

1. Use "Fine Grout" per ASTM C476 for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
2. Use "Coarse Grout" per ASTM C476 for filling 100 mm (4 inch) spaces or larger in both horizontal directions.

**G. Low-Lift Grouting:**

1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 mm<sup>2</sup> (8 square inches) in vertical cores to be grouted.
2. Place vertical reinforcement prior to grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 foot) height, or if bond beam occurs below 1.5 m (5 foot) height, stop pour 38 mm (1-1/2 in) below top of bond beam.
4. Pour grout using chute container with spout or pump hose. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.
5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

**3.13 PLACING MORTAR NET**

- A. Install per manufacturer's instructions.

**SECTION 04 20 00  
UNIT MASONRY**

**3.14 CLEANING AND REPAIR**

- A. General:
  - 1. Clean exposed masonry surfaces on completion.
  - 2. Protect adjoining construction materials and landscaping during cleaning operations.
  - 3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
  - 4. Remove mortar droppings and other foreign substances from wall surfaces.
- B. Brickwork:
  - 1. First wet surfaces with clean water, then wash down with a solution of soapless detergent. Do not use muriatic acid.
  - 2. Brush with stiff fiber brushes while washing, and immediately thereafter hose down with clean water.
  - 3. Free clean surfaces of traces of detergent, foreign streaks, or stains of any nature.
- C. Concrete Masonry Units:
  - 1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
  - 2. Allow mud to dry before brushing.

- - - E N D - - -





**SECTION 04 70 00  
MANUFACTURED STONE VENEER AND TRIM**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Simulated masonry, including manufactured stone veneer, manufactured brick veneer and trim.
- B. Related Sections: Section(s) related to this section include:
  - 1. Section 32 05 23, Cement and Concrete for Exterior Improvements
  - 2. Section 32 91 13, Soil Preparation

**1.02 REFERENCES**

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM C67 Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
  - 2. ASTM C91 Standard Specification for Masonry Cement.
  - 3. ASTM C150 Standard Specification for Portland Cement.
  - 4. ASTM C177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
  - 5. ASTM C207 Standard Specification for Hydrated Lime for Masonry Purposes.
  - 6. ASTM C270 Standard Specification for Mortar for Unit Masonry.
  - 7. ASTM C482 Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.
  - 8. ASTM C567 Standard Test Method for Density Structural Lightweight Concrete.
- C. Underwriters Laboratories, Inc. (UL):
  - 1. UL 723 Standard for Safety for Surface Burning Characteristics of Building Materials.
- D. Uniform Building Code (UBC):
  - 1. UBC Standard No. 32-12 for Water Absorption.
  - 2. UBC Standard No. 14-1 Kraft Waterproof Building Paper
  - 3. UBC Standard No. 26-10 Parts I and IV: Test Method for Compressive Strength of Cylindrical Concrete Specimens.

**1.03 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Product Data: Submit product data, including manufacturer's SPEC-DATA<sup>a</sup> product sheet, for specified products.
- C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures.
- D. Samples: Submit selection and verification samples for finishes, colors and textures.
- E. Quality Assurance Submittals: Submit the following:

**SECTION 04 70 00**  
**MANUFACTURED STONE VENEER AND TRIM**

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
  2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
  3. Manufacturer's Instructions: Manufacturer's installation instructions.
- F. Closeout Submittals: Submit the following:
1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
  2. Warranty: Warranty documents specified herein.

**1.04 QUALITY ASSURANCE**

- A. Qualifications:
1. Installer Qualifications: Installer must have five (5) years minimum experience in performing work of this section who has specialized in installation of work similar to that required for this project.
  2. Manufacturer Qualifications: Must have five (5) years minimum continuous operating experience and have facilities for manufacturing products as described herein. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of manufactured stone veneer, brick veneer and trim products required in accordance with the project schedule.
- B. Mock-Ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, texture and pattern, and workmanship standard. Comply with Division 1 Quality Control (Mock-Up Requirements) Section.
1. Mock-Up Size: 32 sq ft sample panel at jobsite at location as directed.
  2. Pattern: Illustrate field pattern of Stone Field cutting of units where required and color and tooling of joints.
  3. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
  4. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.
- C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

**1.05 DELIVERY, STORAGE & HANDLING**

- A. General: Comply with Division 1 Product Requirements Sections.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

**SECTION 04 70 00**  
**MANUFACTURED STONE VENEER AND TRIM**

**1.05 DELIVERY, STORAGE & HANDLING (Cont)**

D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer. Store mortar and other moisture-sensitive materials in protected enclosures; handle by methods which avoid exposure to moisture.

**1.06 PROJECT CONDITIONS**

A. Environmental Requirements/Conditions: Ambient air temperature shall be in accordance with manufacturer's requirements.

1. Maintain materials and surrounding air temperature to minimum 40 degrees F (4 degrees C) prior to, during and for 48 hours after completion of work.
2. Protect materials from rain, moisture and freezing temperatures prior to, during and for 48 hours after completion of work.
3. Allow no construction activity on opposite side of wall during installation and for 48 hours after completion of work.

**1.07 WARRANTY**

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents..

1. Warranty Period: 30 years commencing on Date of Substantial Completion.

**PART 2 PRODUCTS**

**2.01 MANUFACTURED STONE VENEER (Alternate)**

A. Products:

1. Wall veneer made from noncombustible materials.
2. Listed by Underwriters Laboratories, Inc. (UL Listing #209T)
3. Mortar joints must not exceed 1/2" (12.7 mm) in width and the mortar must be even with the top of the surface.

B. Material Approvals: Provide manufactured stone veneer products with the following approvals:

1. National Evaluation Service - Report NER-358.
2. Building Officials and Code Administrators International (BOCA).
3. International Conference of Building Officials (ICBO).
4. Southern Building Code Congress International (SBCCI).
5. U.S. Department of Housing and Urban Development, Materials Release No. 691c.
5. Underwriters Laboratories, Inc., listed in UL Material Approval Guide.
6. Building Materials Evaluation Commission BMEC #01-04-256.

**SECTION 04 70 00**  
**MANUFACTURED STONE VENEER AND TRIM**

**2.01 MANUFACTURED STONE VENEER (Cont)**

C. Testing:

1. Shipping Weight of Manufactured Units: 8 - 12 psf (39 - 59 kg/m<sup>2</sup>).
2. Compressive Strength: Tested in accordance with UBC Standard No. 26-10, Parts I and IV.
3. Shear (Adhesion) Strength: Tested in accordance with ASTM C482 using a unit thickness approximately the same as the stone unit.
4. Thermal Resistance: K-factor 2.82 in accordance with ASTM C177. R-factor is 0.355 per 1" (25.4 mm) of thickness.
5. Freeze/Thaw: Tested in accordance with ASTM C67.
6. Fire Hazard Test on 1 7/8" (48 mm) Thick Sample: Flamespread of 0, smoke development of 0 in accordance with UL 723.

D. Design Basis:

1. Cultured Stone Products, Texture: Type as indicated below:
  - a. European Castle Stone: Chardonnay.
2. Trim Products, Texture, Color and Size as indicated below:
  - a. Capstones, Flat Textured, Mocha, 12" x 20"

**2.02 MANUFACTURED STONE VENEER THIN CLAD (Alternate)**

A. Products:

1. Wall veneer Thin Clad Tile made from noncombustible materials.
2. Color throughout
3. Mortar joints must not exceed 1/2" (12.7 mm) in width and the mortar must be even with the top of the surface.
4. Sizes: 4", 8", and 12" width x 24" long x 3/4" thick.
5. Strength, durability and dimensional tolerances are within the range of those of quality limestone (ASTM C568) and sandstone products (ASTM C616).

B. Design Basis: Arris Thin Clad Renaissance by Ariscraft International.

**2.03 MANUFACTURED STONE VENEER THIN CLAD (Alternate)**

A. Products:

1. Wall veneer Thin Clad Tile made from noncombustible materials.
2. Color throughout
3. Mortar joints must not exceed 1/2" (12.7 mm) in width and the mortar must be 1/4" below the top of the surface.
4. Sizes:
  - a. Heights: 2 1/4", 5", 7 3/4"
  - b. Lengths: 8-20"
  - c. Depths: 3/4-1 1/4"
5. Strength, durability and dimensional tolerances are within the range of those of quality limestone (ASTM C568) and sandstone products (ASTM C616).

B. Design Basis: Olympia by Natural Stone Veneers International.

**SECTION 04 70 00**  
**MANUFACTURED STONE VENEER AND TRIM**

**2.03 RELATED MATERIALS**

A. Related Materials: Refer to other sections listed in Related Sections specified herein for related materials.

B. Mortar:

1. Portland Cement, ASTM C150, Type I or masonry cement (Type N), ASTM C91.
2. Masonry sand.
3. Lime: ASTM C207.
4. Iron oxide pigments.

C. Masonry Sealer :

1. VOC compliant, water-base, non-gloss, and will not alter appearance of Surface to receive sealer/repellent.
2. Minimum ASTM E-514 Water Leakage Reduction: 95%
3. Design Basis: Pro-So-Co Weatherseal Siloxane PD

D. Weather Resistant Barrier: Kraft waterproof building paper, UBC Standard No. 14-1 or ASTM D226 for Type 1 felt.

E. Metal Lath: 18 gauge galvanized woven wire mesh or galvanized [2.5 lb (1.1 kg) flat diamond mesh] [3.4 lb (1.5 kg) flat rib].

**2.04 MORTAR MIXES**

A. Mixing: Mix proprietary materials in accordance with manufacturer's instructions, including product data and product technical bulletins. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C 270, Type N. Do not use antifreeze compounds to lower the freezing point of mortar.

**2.05 SOURCE QUALITY**

A. Source Quality: Obtain manufactured stone veneer and trim materials from a single manufacturer.

**PART 3 EXECUTION**

**3.01 MANUFACTURER'S INSTRUCTIONS**

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

**3.02 EXAMINATION**

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

**SECTION 04 70 00**  
**MANUFACTURED STONE VENEER AND TRIM**

**3.03 PREPARATION**

**A. Surface Preparation:**

1. Open Stud: Install paperbacked metal lath to studs using galvanized nails or staples which penetrate a minimum of 1" and 4" (25.4 and 102 mm) on center. Apply 1/2" - 3/4" (12.7 - 19.1 mm) scratch coat and allow to dry 48 hours. Wrap weather resistant barrier and metal lath a minimum of 16" (406 mm) around all outside and inside corners.
2. Sheathed Surfaces: Install 1 layer of weather resistant barrier with lap joints 4" (102 mm) shingle fashion. Apply code approved metal lath, attach with galvanized nails or staples which penetrate a minimum of 1" (25.4 mm). Apply 6" (152 mm) on center vertically and 16" (406 mm) on center horizontally. Wrap weather resistant barrier and metal lath a minimum of 16" (406 mm) around all outside and inside corners.
3. Concrete and Masonry Surfaces, New, Clean and Untreated: No preparation needed. Examine newly poured concrete closely to ensure that its finished surface contains no releasing agents (form oil). If it does contain form oil, etch surface with muriatic acid, rinse thoroughly and/or score with a wire brush, or use high pressure water or sandblasting to remove.

**3.04 MANUFACTURED STONE VENEER INSTALLATION**

A. Mortar: Apply 1/2" - 3/4" (12.7 - 19.1 mm) of mortar to dampened concrete surfaces, covering a maximum of 10 ft<sup>2</sup> (0.93 m<sup>2</sup>) at one time. Press the units firmly into position in soft mortar bed, wiggle and apply slight pressure to unit to ensure firm bonding, causing mortar to extrude slightly around edges of units.

B. Joints: Place units with uniform mortar joints. Stone joints should not be over 1/2" maximum (12.7 - 19.1 mm) in width. When installing pre-fitted stone textures units should be fitted tight against each other with no allowance for mortar joints.

1. Remove excess mortar; do not allow mortar to set up on face of units. Point Rake and tool joints before mortar has set. Clean and finish joints in accordance with manufacturer's instructions.

C. Setting Units: Press each stone into the mortar setting bed firmly enough to squeeze some mortar out around the stone's edges. Apply pressure to the stone to ensure a good bond. Ensure complete coverage between the mortar bed and back surface of the stone. Mortar may also be applied to the entire back of the stone.

D. Cutting: Perform necessary cutting with proper tools to provide uniform edges; take care to prevent breaking unit corners or edges.

F. Related Products Installation: Refer to other sections listed in Related Sections specified herein for related materials installation.

**3.05 CLEANING**

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Remove construction debris from project site and legally dispose of debris.

1. Cleaning: Use a strong solution of granulated soap or detergent and water with a bristle brush. Do not use a wire brush as it will cause damage to the surface. Rinse immediately with fresh water. Do not attempt to clean using acid or acid based products. Do not clean with high pressure power washer.

**SECTION 04 70 00**  
**MANUFACTURED STONE VENEER AND TRIM**

**3.05 CLEANING (Cont)**

2. Salt and De-icing Chemicals: Do not use de-icing chemicals on areas immediately adjacent to a Cultured Stone products application.
3. Scuffing: Remove scuff marks by cleaning as specified herein.
4. Efflorescence: To remove efflorescence, allow stone to dry thoroughly, and then scrub vigorously with a stiff bristle brush and clean water. Rinse thoroughly. Do not use a wire brush. For difficult efflorescence problems, scrub thoroughly with a solution of 1 part white household vinegar to 5 parts water. Rinse thoroughly.

**3.06 PROTECTION**

- A. Protection: Protect installed product and finish surfaces from damage during construction.

**END OF SECTION**





**SECTION 04 72 00  
CAST STONE MASONRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This sections specifies manufactured concrete units to simulate a natural stone.
- B. Installation of cast stone units.

**1.2 RELATED WORK**

- A. Setting and pointing mortar: Section 04 05 13, MASONRY MORTARING / Section 04 05 16, MASONRY GROUTING.
- B. Joint sealant and application: Section 07 92 00, JOINT SEALANTS.
- C. Color and texture specified in Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Cast stone, sample panel, size 100 by 300 by 300 mm (4 by 12 by 12 inches) each color and finish.
- C. Shop Drawings:
  - 1. Cast stone showing exposed faces, profiles, cross sections, anchorage, reinforcing, jointing and sizes.
  - 2. Setting drawings with setting mark.
- D. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Store cast stone under waterproof covers on planking clear of ground.
- B. Protect from handling, dirt, stain, and water damage.
- C. Mark production units with the identification marks as shown on the shop drawings.
- D. Package units and protect them from staining or damage during shipping and storage.

**1.5 WARRANTY**

Warranty exterior masonry walls against moisture leaks, any defects and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be two years.

**SECTION 04 72 00  
CAST STONE MASONRY**

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. Cast Stone Institute Technical Manual and Cast Stone Institute standard specifications.
- C. American Society for Testing and Materials (ASTM):
  - A167-99(R2009).....Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - A185-07 .....Steel, Welded Wire Fabric, Plain for Concrete

**1.6 APPLICABLE PUBLICATIONS (CONT)**

- A615/ A615M-09.....Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- C33-11 .....Concrete Aggregates
- C150-09 .....Portland Cement
- C568-10 .....Limestone Dimension Stone
- C1194-03 .....Compressive Strength of Architectural Cast Stone
- C1195-03 .....Absorption of Architectural Cast Stone
- C1364-10 .....Architectural Cast Stone.

**1.7 QUALITY ASSURANCE**

- A. The Manufacturer:
  - 1. Must have ten (5) years minimum continuous operating experience and have facilities for manufacturing cast stone as described herein. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of cast stone required in accordance with the project schedule.
  - 2. Must be a member of the Cast Stone Institute.
  - 3. Must have a certified plant (certification by the Cast Stone Institute).
- B. Stone setter: Must have ten (5) years experience setting cast or natural building stone.

**1.8 MANUFACTURING TOLERANCES**

- A. Cross section dimensions shall not deviate by more than + 1/8 in. (3 mm) from approved dimension.
- B. Length of units shall not deviate by more than length /360 or + 1/8 in. (3mm), whichever is greater, not to exceed + 1/4 in (6 mm). Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.
- C. Warp bow or twist of units shall not exceed length/360 or + 1/8 in. (3 mm), whichever is greater.
- D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features
  - On formed sides of unit, 1/8 in (3 mm), on unformed sides of unit, 3/8 in (9 mm) maximum deviation.

**SECTION 04 72 00  
CAST STONE MASONRY**

**PART 2 - PRODUCTS**

**2.1 ARCHITECTURAL CAST STONE**

- A. Comply with ASTM C 1364
- B. Physical properties: Provide the following:
  - 1. Compressive Strength – ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
  - 2. Absorption – ASTM C 1195: 6% maximum by the cold water method, or 10% maximum by the boiling method for products as 28 days.
  - 3. Air Content – ASTM C173 or C231, for wet cast product shall be 4-8% for units exposed to freeze-thaw environments. Air entrainment is not required for vibrant dry tamp (VDT) products.

**2.1 ARCHITECTURAL CAST STONE (CONT)**

- 4. Freeze thaw - ASTM C 1364L The cumulative percent weight loss (CPWL) shall be less than 5% after 300 cycles of freezing and thawing.
- 5. Linear Shrinkage - ASTM C 426L Shrinkage shall not exceed 0.065%.

**2.2 RAW MATERIALS**

- A. Portland cement – Type I or Type III, white and/or grey, ASTM C 150.
- B. Coarse aggregates – Limestone, ASTM C 33, except for gradation, and are optional for the vibrant dry tamp (VDT) casting method.
- C. Fine aggregates – Manufactured or natural sands, ASTM C 33, except for gradation.
- D. Colors – Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.
- E. Admixtures- Comply with the following:
  - 1. ASTM C 260 for air-entraining admixtures.
  - 2. ASTM C 494/C 495 M Types A-G for water reducing, retarding, accelerating and high range admixtures.
  - 3. Other admixtures: integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
  - 4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.
  - 5. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.
- F. Water – Potable
- G. Reinforcing bars:
  - 1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 in. (37 mm).
  - 2. Welded Wire Fabric: ASTM A 185 where applicable for wet cast units.
- H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304.

**SECTION 04 72 00  
CAST STONE MASONRY**

**2.3 COLOR AND FINISH**

- A. Match sample on file.
- B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 in. (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 in<sup>2</sup> (25mm<sup>2</sup>) and not obvious under direct daylight illumination at a 5 ft. (1.5m) distance.
- C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 ft (3m) distance.
- D. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
  - 1. Total color difference – not greater than 6 units.
  - 2. Total hue difference-not greater than 2 units.

**2.4 REINFORCING**

- A. Reinforce the units as required by the drawings and for safe handling and structural stress.
  - 1. Minimum reinforcing shall be 0.25 percent of the cross section area.
- B. Reinforcement shall be non-corrosive where faces exposed to weather are covered with less than 1.5in. (38 mm) of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.
- C. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20-ft (6m) distance.
- D. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.
- E. Remove cement film, if required, from exposed surface prior to packaging for shipment.

**2.5 CURING**

Cure units in a warm curing chamber 1000 F (537.8 C) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 700F (371.1 C) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350-degree-days (i.e. 7 days @ 500F (260.0 C) or 5 days @ 700F (371.1 C) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

**PART 3 – EXECUTION**

**3.1 EXAMINATION**

Installing contractor shall check cast stone materials for fit and finish prior to installation. Do not set unacceptable units.

**3.2 SETTING TOLERANCES**

- A. Comply with Cast Stone Institute<sup>SM</sup> Technical Manual.
- B. Set stones 1/8 in. (3 mm) or less, within the plane of adjacent units.
- C. Joints, plus – 1/6 in. (1.5 mm), minus – 1/8 in. (3 mm).

**SECTION 04 72 00  
CAST STONE MASONRY**

**3.3 JOINTING**

- A. Joint size:
  - 1. At stone/brick joints 3/8 in. (9.5 cm).
  - 2. At stone/stone joints in vertical position 1/4 in. (6 mm) (3/8 in. (9.5 mm) optional).
  - 3. Stone/stone joint exposed on top 3/8 in. (.5 mm).
- B. Joint Materials:
  - 1. Mortar, Type N, ASTM C 270.
  - 2. Use a full bed of mortar at all bed joints.
  - 3. Flush vertical joints full with mortar.
  - 4. Leave all joints with exposed tops or under relieving angles open for sealant.
  - 5. Leave head joints in coping and projecting components open for sealant.
- B. Location of joints:
  - 1. As shown on shop drawings.
  - 2. At control and expansion joints unless otherwise shown.

**3.4 SETTING**

- A. Drench units with clean water prior to setting.
- B. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
- C. Set units in full bed of mortar, unless otherwise detailed.
- D. Rake mortar joints 3/4 in. (18 mm) in. for pointing.
- E. Remove excess mortar from unit faces immediately after setting.
- F. Tuck point unit joints to a slight concave profile.

**3.5 JOINT PROTECTION**

- A. Comply with requirements of Section 07 92 00, JOINT SEALANTS.
- B. Prime ends of units, insert properly sized backing rod and install required sealant.

**3.6 REPAIR AND CLEANING**

- A. Repair chips with touchup materials furnished by manufacturer.
- B. Saturate units to be cleaned prior to applying an approved masonry cleaner.
- C. Consult with manufacturer for appropriate cleaners.

**3.7 INSPECTION AND ACCEPTANCE**

Inspect finished installation according to Bulletin #36 published by the Cast Stone Institute.

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**SECTION 05 12 00**  
**STRUCTURAL STEEL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies structural steel shown and classified by Code of Standard Practice for Steel Buildings and Bridges, Section 2.

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Painting: Section 09 91 00, PAINTING.
- C. Steel Decking: Section 05 31 00, STEEL DECKING.
- D. Composite Steel Deck: Section 05 36 00, COMPOSITE METAL DECKING.
- E. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.

**1.3 QUALITY ASSURANCE:**

- A. Fabricator and erector shall maintain a program of quality assurance in conformance with Section 8, Code of Standard Practice for Steel Buildings and Bridges. Work shall be fabricated in an AISC certified Category Complex Steel Building Structures fabrication plant. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."
- B. Before authorizing the commencement of steel erection, the controlling contractor shall ensure that the steel erector is provided with the written notification required by 29 CFR 1926.752. Provide copy of this notification to the Resident Engineer.

**1.4 TOLERANCES:**

Fabrication tolerances for structural steel shall be held within limits established by ASTM A6, by Code of Standard Practice for Buildings and Bridges, Section 7, and by Standard Mill Practice - General Information (AISC Steel Construction Manual, Thirteenth Edition, Pages 1-117 to 1-125), except as follows:

- A. Elevation tolerance for column splice points at time member is erected is 10 mm (3/8 inch).
- B. Elevation tolerance for top surface of steel beams and girders at connections to columns at time floor is erected is 13 mm (1/2 inch).
- C. Elevation tolerance for closure plates at the building perimeter and at slab openings prior to concrete placement is 6 mm (1/4 inch).

**SECTION 05 12 00  
STRUCTURAL STEEL FRAMING**

**1.5 REGULATORY REQUIREMENTS:**

- A. AISC: AISC 360-05 Specification for Structural Steel Buildings
- B. AISC: AISC 303-05 Code of Standard Practice for Steel Buildings and Bridges.

**1.6 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop and Erection Drawings: Complete. Indicate profiles, sizes, spacing, cambers, locations of structural members, openings, attachments, and fasteners.
- C. Certificates:
  - 1. Structural steel.
  - 2. Steel for all connections.
  - 3. Welding materials.
  - 4. Shop coat primer paint.
  - 5. Welder Certifications.
- D. Test Reports:
  - 1. Welders' qualifying tests.
- E. Record Surveys.

**1.7 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced.  
Publications are referenced in text by basic designation only.
- B. American Institute of Steel Construction (AISC):
  - 1. AISC 360-05 Specification for Structural Steel Buildings.
  - 2. AISC 303-05 Code of Standard Practice for Steel Buildings and Bridges.
- C. American National Standards Institute (ANSI):
  - B18.22.1-65(R2008) .....Plain Washers
  - B18.22M-81(R2000).....Metric Plain Washers
- D. American Society for Testing and Materials (ASTM):
  - A6/ A6M-09.....Standard Specification for General Requirements for  
Rolled Structural Steel Bars, Plates, Shapes, and Sheet  
Piling
  - A36/ A36M-08.....Standard Specification for Carbon Structural Steel



**SECTION 05 12 00**  
**STRUCTURAL STEEL FRAMING**

- A53/ A53M-10.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
- A123/ A123M-09.....Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- A242/ A242M-04(R2009) .....Standard Specification for High-Strength Low-Alloy Structural Steel
- A283/ A283M-03(R2007) .....Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
- A307-10.....Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- A325-10.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- A490-10.....Standard Specification for Heat-Treated Steel Structural Bolts 150 ksi Minimum Tensile Strength
- A500/ A500M-10.....Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- A501-07.....Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
- A572/ A572M-07.....Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
- A992/ A992M-06.....Standard Specification for Structural Steel Shapes
- E. American Welding Society (AWS):
- D1.1/D1.1M-10.....Structural Welding Code-Steel
- F. Research Council on Structural Connections (RCSC) of The Engineering Foundation: Specification for Structural Joints Using ASTM A325 or A490 Bolts June 2004
- G. Military Specifications (Mil. Spec.):
- MIL-P-21035.....Paint, High Zinc Dust Content, Galvanizing, Repair
- H. Occupational Safety and Health Administration (OSHA):
- 29 CFR Part 1926-2001 .....Safety Standards for Steel Erection

**SECTION 05 12 00**  
**STRUCTURAL STEEL FRAMING**

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. Structural Steel: As indicated on drawings.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53, Grade B.
- E. Bolts, Nuts and Washers:
  - 1. High-strength bolts, including nuts and washers: ASTM A325 and A490.
  - 2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
  - 3. Plain washers, other than those in contact with high-strength bolt heads and nuts:  
ANSI Standard B18.22.1.
- F. Zinc Coating: ASTM A123.
- G. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035.
- H. Headed Stud-Type Shear Connectors: ASTM A108, Grade 1015 or 1020, cold-finished carbon steel with dimensions complying with AISC Specifications.

**PART 3 - EXECUTION**

**3.1 EXAMINATION:**

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

**3.2 DELIVERY, STORAGE AND HANDLING**

- B. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports.
- D. Protect steel members and packaged materials from corrosion and deterioration.

**3.3 CONNECTIONS (SHOP AND FIELD):**

- A. Welding: Welding in accordance with AWS D1.1. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.1 to perform type of work required.
- B. High-Strength Bolts: High-strength bolts tightened to a bolt tension not less than proof load given in Specification for Structural Joints Using ASTM A325 or A490 Bolts.  
Tightening done with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in connections identified as

**SECTION 05 12 00**  
**STRUCTURAL STEEL FRAMING**

slip-critical using Direct Tension Indicators or the turn-of-the-nut method. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

**3.4 FABRICATION:**

Fabrication in accordance with AISC 360, Chapter M, Specification for Steel Buildings

**3.5 SHOP PAINTING:**

- A. General: Shop paint steel with primer in accordance with AISC 303, Section 6, Code of Standard Practice for Steel Buildings and Bridges.
- B. Shop paint for steel surfaces is specified in Section 09 91 00, PAINTING.
- C. Do not apply paint to the following:
  - 1. Surfaces within 50 mm (2 inches) of joints to be welded in field.
  - 2. Surfaces which will be encased in concrete.
  - 3. Surfaces which will receive sprayed on fireproofing.
  - 4. Top flange of members which will have shear connector studs applied.
- D. Zinc Coated (Hot Dip Galvanized) per ASTM A123 (after fabrication): Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.

**3.6 ERECTION:**

- A. General: Erection in accordance with AISC 303, Section 7, Code of Standard Practice for Steel Buildings and Bridges.
- B. Temporary Supports: Temporary support of structural steel frames during erection in accordance with AISC 303, Section 7, Code of Standard Practice for Steel Buildings and Bridges.
- C. Shop Errors:
  - 1. Immediately report to the Resident Engineer any errors in shop fabrication or deformation resulting from handling and shipping.
  - 2. Obtain approval of method of correction before proceeding with erection.
  - 3. Make approved connections without additional cost to Owner.
- D. Splice members only where indicated.
- E. Thermal Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members

**SECTION 05 12 00**  
**STRUCTURAL STEEL FRAMING**

that are not under stress, as approved by the Engineer. Finish gas-cut sections equal to a sheared appearance with permitted.

- F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

**3.7 FIELD PAINTING:**

- A. After erection, touch-up steel surfaces specified to be shop painted. After welding is completed, clean and prime areas not painted due to field welding.
- B. Finish painting of steel surfaces is specified in Section 09 91 00, PAINTING.

**3.8 SURVEY:**

Upon completion of finish bolting or welding on any part of the work, and prior to start of work by other trades that may be supported, attached, or applied to the structural steel work, submit a certified report of survey to Resident Engineer for approval.

Reports shall be prepared by Registered Land Surveyor or Registered Civil Engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS. Report shall specify that location of structural steel is acceptable for plumbness, level and alignment within specified tolerances specified in the AISC Manual.

**3.9 SHEAR CONNECTORS:**

Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld shear connectors in filed, spaced as shown on the drawings. Use automatic end welding of headed stud shear connectors in accordance with the manufacturer's printed instructions.

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**SECTION 05 12 60**  
**BUCKLING-RESTRAINED BRACES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Provide completed Buckling-Restrained Brace (BRB) assemblies ready for installation. The buckling restrained brace assemblies shall include scratch plate type measurement devices at one end of one unit of each scheduled type, capable of recording the maximum displacement experienced by the brace during an earthquake. The General Contractor shall provide all gusset plates, splice plates and fasteners necessary to connect the splice plates to the BRB and the splice plates to the gusset plates, and for installation of the scratch plates.
- B. Manufacturer: CoreBrace, LLC

**1.2 RELATED SECTIONS**

- 1. Section 03 30 00, CAST-IN-PLACE CONCRETE.
- 2. Section 05 12 00, STRUCTURAL STEEL.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings: Submit for review:
  - 1. Indicate profiles, lengths, plate thicknesses, outer tube geometry, dimensions outside of the tube, and hole locations for connections.
  - 2. Component and overall assembly weights.
  - 3. Certified yield strength of steel plates.
  - 4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths and finishes.
  - 5. Details of connections of brace to gusset plate, gusset plate assemblies and the connection of the gusset plate assemblies to the building structural steel frame.
  - 5. Drawings only cover the general scheme, design, and character of the details. Field verification of existing conditions and dimensions may be required and is the responsibility of the Contractor. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents and coordination between the manufacturer and the Contractor.
  - 6. Details of proposed scratch plate type displacement measurement devices.
- C. Certificates: Submit for information:
  - 1. Manufacturer's Mill Certificates: Certify that materials meet specified requirements.

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**BUCKLING-RESTRAINED BRACES**

2. Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis.
  3. Welder's Certificates: Certify welders employed on the Work, verifying AWS or equivalent qualification within the previous 12 months.
  4. Brace Manufacturer's Professional Engineer qualifications, in accordance with Section 1.4.B.
- D. Product Data: Manufacturer to provide a submittal prior to commencing BRB design detailing the following:
1. Experience in supplying hysteretic damping devices for seismic applications.
  2. Description of previous similar projects.
  3. Installation instructions.
  4. Recommended periodic and post-earthquake maintenance, inspection, and testing requirements.
- E. Technical Submittal: Manufacturer to provide a technical submittal, stamped and signed by the Brace Manufacturer's Professional Engineer, prior to commencing BRB manufacture, and within 30 days of award of contract, detailing the following:
1. Brace documented Design Methodology – in conformance with AISC 341 Seismic Provisions for Structural Steel Buildings.
  2. Results from previous brace and subassembly testing, performed in accordance with AISC 341, Seismic Provisions for Structural Steel Buildings.
  3. Brace design calculations demonstrating compliance with the requirements the AISC Seismic Provisions, and Section 2.4, except that the total cumulative plastic ductility for a qualifying test of brace shall not be less than 240 and the value of  $\omega \times \beta$  shall not exceed 1.5 at a core plate plastic strain corresponding to 1% building drift.
  4. Brace connection and configuration – calculations for the brace connection and gusset plate assemblies to the building structural frame. The connections shown on the drawings are for reference only. The brace connections to the building frame are to be designed and detailed by the BRB manufacturer, including, but not limited to bolting, welds, gusset plates and stiffeners.
- F. Quality Control: Submit proposed quality assurance/quality control procedures in conformance with Section 1.4.
1. Submit results of quality assurance testing including weld inspection reports.

**SECTION 05 12 60**  
**BUCKLING-RESTRAINED BRACES**

- G. Schedule: Submit schedule for fabrication, assembly, and delivery to site of complete BRB assemblies within 14 days of contract award. Coordinate with Resident Engineer for inspection of brace fabrication and assembly, and project team visit.
- H. General: All submittals shall be made in English.

**1.4 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Shall have manufactured and successfully tested braces in accordance with AISC 341, Seismic Provisions for Structural Steel Buildings. In particular, previously manufactured and tested braces shall meet the requirements of Appendix T for the range of Prototype braces present on the project.
- B. Design Engineer Qualifications: Registered Professional Engineer, in the State of Oregon, with ten years experience in the design, construction, and testing of steel hysteretic energy dissipation devices for seismic protection of buildings.
- C. Erector Qualifications: Company specializing in performing the work of this section, with minimum 10 years documented experience in steel erection.
- D. Standards:
  - 1. Fabricate Buckling-Restrained Brace in accordance with AISC 303 Code of Standard Practice, or equivalent. Changes in BRB or connection design from those shown in the contract documents shall only be made upon approval by the Resident Engineer and SEOR.
  - 2. Maintain one copy of each document on site.
- E. Regulatory Requirements: International Building Code and AISC requirements.
- F. Manufacturer to notify the Resident Engineer a minimum of 30 days prior to fabrication and assembly of braces, to allow for observation.
- G. Brace fabrication and assembly shall occur in no more than two uninterrupted periods each not too exceed three weeks in duration without prior approval from the Resident Engineer.

**1.5 APPLICABLE PUBLICATIONS**

- A. American Institute of Steel Construction (AISC):
  - 1. Specification for Structural Steel Buildings, 2005, (AISC 360-05).
  - 2. Code of Standard Practice for Steel Buildings and Bridges, 2005, (AISC 303-05).
  - 3. Seismic Provisions for Structural Steel Buildings, Including Supplement No. 1, 2005 (AISC 341-05).
  - 4. Specification for Structural Joints Using ASTM A325 or A490 Bolts, 2004.

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**BUCKLING-RESTRAINED BRACES**

**B. American Society for Testing and Materials (ASTM):**

- A36/ A36M-08.....Standard Specification for Carbon Structural Steel
- A53/ A53M-10.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
- A325-10.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- A490-10.....Standard Specification for Heat-Treated Steel Structural Bolts 150 ksi Minimum Tensile Strength
- A500/ A500M-10.....Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- A501-07.....Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
- A514-05(2009) .....High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
- A563/563M-07a.....Standard Specification for Carbon and Alloy Steel Nuts
- F436-11.....Standard Specification for Hardened Steel Washers
- F1852-08.....Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

**C. American Welding Society (AWS):**

- A2.4: 2007 .....Symbols for Welding, Brazing, and Nondestructive Examination.
- D1.1/D1.1M: 2010 .....Structural Welding Code - Steel.

**D. Steel Structures Painting Council (SSPC) - Steel Structures Painting Manual.**

**E. International Building Code (IBC), 2009 Edition.**

**F. Warnock Hercy - Certification Listings.**

**G. Japanese Industrial Standard:**

- G 3136 SN400 B.....Rolled Steels for Building Structures
- G 3466 STKR 400 .....Carbon Steel Square Pipes for General Structural Purposes



**SECTION 05 12 60**  
**BUCKLING-RESTRAINED BRACES**

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Yielding Core Plate: ASTM A36, or equal. The 0.2% offset yield stress shall meet the requirements of Section 2.4.
- B. Other Structural Steel Plate: ASTM A36, ASTM A572 Gr. 50, or equal.
- C. Structural Tubing: ASTM A500, Grade B, or equal.
- D. Welding Materials: See Section 05 12 00 STRUCTURAL STEEL.
- E. Structural Steel Primer Paint: Section 05 12 00 STRUCTURAL STEEL.

**2.2 FABRICATION**

- A. Fabricate Buckling Restrained Braces in accordance with AISC 303, Code of Standard Practice, including Section 10 – Architecturally Exposed Structural Steel, or equivalent.
- B. Grind welds exposed to view in finished configuration smooth. Bevels for full-penetration welds shall be in accordance with AISC/ AWS Standards, or equivalent.
- C. Fabricate connections for bolt, nut, and washer connectors. All holes for bolted connections shall be drilled, and burrs removed in accordance with AISC 303, Code of Standard Practice, or equivalent. All holes shall be standard size holes as defined by AISC.
- D. Assemble components of the brace in a manner to ensure proper performance of the brace.
- E. All brace dimensions shall comply with the requirements of the Drawings and shall be coordinated with the existing conditions. Report any discrepancies to the Resident Engineer.
- F. The steel core plate shall be fabricated and treated to prevent warping.
- G. Provide lifting lugs to facilitate brace installation. Coordinate lifting lug locations so that when braces are lifted into place the scratch plate devices are correctly oriented. Lifting lugs shall not increase the overall thickness of the brace assembly when installed. At locations where braces are to be exposed contractor lifting lugs shall be omitted and the contractor shall use alternates means of brace installation, except on approval of the Resident Engineer.

**2.3 SHOP PRIME PAINTING**

- A. Shop prime paint structural steel, except those members or portions of members to be fireproofed or embedded in concrete. Prime paint embedded steel, which is partially exposed, on exposed portions and initial 2 inches of embedded areas only.

**SECTION 05 12 60**  
**BUCKLING-RESTRAINED BRACES**

- B. Do not prime paint surfaces, which are to be welded. Do not prime paint the faying surfaces of connections specified to be slip-critical.
- C. After inspection and before shipping, clean steel work to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits.
- D. Clean steel in accordance with Steel Structures Painting Council (SSPC) and as required by the paint manufacturer's recommendations. Also prepare the surface as a minimum in accordance with the following:
  - 1. SP-1 "Solvent Cleaning." And
  - 2. SP-2 "Hand Tool Cleaning" or SP-3 "Power Tool Cleaning."
- E. Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 1.5 mils. Use painting methods, which result in full coverage of joints, corners, edges and exposed surfaces.

**2.4 SOURCE QUALITY CONTROL AND TESTS**

- A. The BRB shall be manufactured to meet the following design requirements and those identified on the drawings.
- B. The brace manufacturer shall engage a Professional Engineer, licensed in the State of Oregon, to design the project braces. The design shall be based on the contract documents, and AISC 341, Seismic Provisions for Structural Steel Buildings, except as noted in the Technical Submittal requirements. Interpolation of test results for different member sizes shall be justified by rational analysis that demonstrates internal strain demands and calculated factors of safety that are less severe than those present in successfully tested assemblies.
- C. Steel used as the yielding element shall meet the requirements for ASTM A36, or approved equivalent. Manufacturer shall supply mill certifications (stress strain curve) for the steel used in the BRB core, detailing yield force and ultimate tensile strain.
- D. The hysteretic behavior of the BRBs in the range of in-plane displacements up to 3 percent story drift will not experience global buckling and will show no sign of pinching or other degradation or loss of strength.
- E. The BRB is to remain intact and provide for stable loading. The BRB should allow for simultaneous axial loading, out-of-plane forces equaling 1g, additional out-of-plane forces as noted in the construction documents and out-of-plane displacements equal to 3.0% of the installed story height indicated on the contract documents.

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**BUCKLING-RESTRAINED BRACES**

- F. The buckling-restraining system shall provide full confinement without degradation and/or loss of material. End confining plates shall be provided to ensure confinement of the fill while allowing for non-restricting movement of the core plate.
- G. The manufacturer, subject to limitations shown on the drawings, shall determine the cross-sectional dimension of the BRB assembly. The cross-sectional area of the BRB core shall be determined based on the forces specified in the contract documents and on the steel properties determined by the following coupon tests:
  - 1. Sample and test in accordance with ASTM E8, plate type tests. Provide plot of tensile stress vs. elongation for each test. Report initial yield, yield at zero point two percent (0.2%) offset, stress at 2.0% elongation, and maximum elongation of each specimen.
  - 2. Take samples from plates at point of manufacture. The axis of the coupon test specimen shall be parallel to the axis of the brace core plates.
  - 3. Take a minimum of three specimens from each heat of steel, spaced sufficiently to represent the plate used for the fabrication of the core plates for the project.
  - 4. The average yield stress (0.2% offset) for each heat of steel shall be used to confirm the yield stress properties used in the design of the sizes of the core plates for the BRBs.
  - 5. The average yield stress from coupon testing shall fall between 38 ksi and 46 ksi. The average yield stress from coupon testing shall be within  $\pm 2$  ksi of that assumed in the design of the sizes of the core plates for the BRBs.
- H. The dimensions of the steel tube shall be determined as necessary for proper operation of the BRB assembly, subject to limitations shown on the contract drawings.
- I. The BRB assemblies shall be intended to be maintenance-free for a life of 35 years. Maintenance-free shall mean that no replacement of parts shall be required and the confining fill element shall maintain function without degradation or loss of material. BRB components shall be specified as in Section 2.1.
- J. The BRB assemblies shall maintain their design properties within a temperature range of 0 to 45 degrees C (32 to 113 degrees F).
- K. Upon completion of fabrication, manufacturer shall submit a list of shop mark designations and photos of each brace to the Resident Engineer for review.

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**BUCKLING-RESTRAINED BRACES**

- L. Scratch plate assemblies shall be designed and installed to be capable of indicating the required range of movement shown on the Contract Documents without interference from surrounding structural or architectural components.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verify existing conditions prior to beginning Work.

**3.2 SHIPPING**

- A. Manufacturer to provide protection of the brace, connecting components, and scratch plate measurement devices, to ensure against damage and weather during shipping and storage at the site.
- B. Manufacturer to pay all shipping and related costs for delivery to the site. Manufacturer to coordinate with the Resident Engineer and Contractor for delivery dates and quantities. Contractor to provide proper lay-down and storage areas.

**3.3 ERECTION**

- A. Erect BRBs in accordance with referenced AISC Specifications. Manufacturer to coordinate with the Contractor and Steel Erector to verify lengths, connections, shipping, storage and field conditions.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of BRBs.
- C. Field connect members with threaded fasteners; torque to required resistance or welded connections.
- D. Do not field cut or alter structural members without approval of the Resident Engineer and SEOR.
- E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with grout or bolts.
- F. Install scratch plate measure devices at the upper end on the top or bottom surface of the each required brace in a location visible from the inside of the building. Coordinate scratch plate locations with lifting lug locations as necessary for proper installation.

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**SECTION 05 31 00  
STEEL DECKING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies material and services required for installation of steel decking as shown and specified.

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- C. Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Finish Painting: Section 09 91 00, PAINTING.

**1.3 DESIGN REQUIREMENTS:**

- A. Design steel decking in accordance with AISI publication, "Specification for the Design of Cold-formed Steel Structural Members" except as otherwise shown or specified. See Construction Documents for specified decking.
- B. Design all elements with the latest published version of applicable codes.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and similar information necessary for completing installation as shown and specified, including supplementary framing, sump pans, ridge and valley plates, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying structural characteristics.
- D. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a "Steel Floor and Form Unit".
- E. Insurance Certification: Assist the Government in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.

**SECTION 05 31 00  
STEEL DECKING**

**1.5 QUALITY ASSURANCE:**

- A. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.
- B. FM Listing: Provide metal roof deck units which have been evaluated by Factory Mutual Global and are listed in "Factory Mutual Research Approval Guide" for "Class 1" fire rated construction.

**1.6 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced.  
Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A36/ A36M-08.....Standard Specification for Carbon Structural Steel
  - A611-97 .....Standard Specification for Structural Steel (SS), Sheet,  
Carbon, Cold-Rolled
  - A653/ A653M-10.....Standard Specification for Steel Sheet, Zinc-Coated  
(Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by  
the Hot-Dip Process
  - C423-09a .....Standard Test Method for Sound Absorption and Sound  
Absorption Coefficients by the Reverberation Room  
Method
- C. American Institute of Steel Construction (AISC):
  - 1. Specification for Structural Steel Buildings (ANSI/ AISC 360-05)
- D. American Iron and Steel Institute (AISI):
  - 1. Specification and Commentary for the Design of Cold-Formed Steel Structural  
Members (AISI S100-07)
- E. American Welding Society (AWS):
  - D1.3-08 .....Structural Welding Code - Sheet Steel
- F. Factory Mutual (FM Global):
  - 1. Loss Prevention Data Sheet 1-28: Wind Loads to Roof Systems and Roof Deck  
Securement
  - 2. Factory Mutual Research Approval Guide (2002)
- G. Military Specifications (Mil. Spec.)

**SECTION 05 31 00  
STEEL DECKING**

MIL-P-21035B .....Paint, High Zinc Dust Content, Galvanizing Repair

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. Steel Decking: ASTM A653, Structural Quality.
- B. Galvanizing: ASTM A653, G60 or G90.
- C. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- D. Primer for Shop Painted Sheets: Manufacturer's standard primer (2 coats). When finish painting of steel decking is specified in Section 09 91 00, PAINTING primer coating shall be compatible with specified finish painting.
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Welding Electrode: E70XX minimum.
- G. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:
  - 1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
  - 2. Continuous Sheet Metal Edging: At openings, concrete slab edges and roof deck edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.
  - 3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
  - 4. Ridge and Valley Plates: Provide 1.3 mm (18 gauge), minimum 100 mm (4 inch) wide ridge and valley plates where roof slope exceeds 40 mm per meter (1/2 inch per foot).

**SECTION 05 31 00  
STEEL DECKING**

5. Cant Strips: Provide bent metal 45 degree leg cant strips where indicated on the Drawings. Fabricate cant strips from 1 mm (20 gauge) metal with a minimum 125 mm (5 inch) face width.
6. Seat Angles for Deck: Provide where a beam does not frame into a column.
7. Sump Pans for Roof Drains: Fabricated from single piece of minimum 1.9 mm (14 gauge) galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 75 mm (3 inches) wide. Recess pans not less than 38 mm (1 1/2 inches) below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

**2.2 REQUIREMENTS:**

- A. Provide steel decking of the type, depth, gauge, and section properties as shown.
- B. Metal Form Deck - Type 1: Single pan fluted units utilized as a permanent form for reinforced concrete slabs. Comply with the depth and gauge requirements as shown on the Contract Documents.
  1. Finish: Galvanized G-60.
- D. Metal Roof Deck: Single pan fluted units with flat horizontal top surfaces utilized to act as a permanent support for all superimposed loads. Comply with the depth and minimum gage requirements as shown on the Contract Documents.
  1. Finish: Galvanized G-90.
- E. Do not use steel deck for hanging supports for any type or kind of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.
- F. Recycled Content:
  1. Basic Oxygen Furnace steel: Minimum 20 percent post-consumer recycled content and minimum 10 percent pre-consumer recycled content.
  2. Electric Arc Furnace steel: Minimum 55 percent post-consumer recycled content and minimum 30 percent pre-consumer recycled content.



**SECTION 05 31 00  
STEEL DECKING**

**PART 3 - EXECUTION**

**3.1 ERECTION:**

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.
- D. Provide steel decking in sufficient lengths to extend over 3 or more spans.
- E. Place steel decking units at right angles to supporting members. End laps of sheets of roof deck shall be a minimum of 50 mm (2 inches) and shall occur over supports.
- F. Fastening Deck Units:
  - 1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. with a minimum of two welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.
  - 2. Tack weld or use self-tapping No. 8 or larger machine screws at 915 mm (3 feet) o.c. for fastening end closures. Only use welds to attach longitudinal end closures.
  - 3. Weld side laps of adjacent floor deck units that span more than 1524 mm (5 feet). Fasten at midspan or 915 mm (3 feet) o.c., whichever is smaller.
  - 4. Fasten roof deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. at every support, and at closer spacing where required for lateral force resistance by diaphragm action. Attach split or partial panels to the structure in every valley. In addition, secure deck to each supporting member in ribs where side laps occur. Power driven fasteners may be used in lieu of welding for roof deck if strength equivalent to the welding specified above is provided. Submit test data and design calculations verifying equivalent design strength.

**SECTION 05 31 00  
STEEL DECKING**

5. Mechanically fasten side laps of adjacent roof deck units with spans greater than 1524 mm (5 feet) between supports, at intervals not exceeding 915 mm (3 feet) o.c., or midspan, whichever is closer, using self-tapping No. 8 or larger machine screws.
6. Provide any additional fastening necessary to comply with the requirements of Underwriters Laboratories and/or Factory Mutual to achieve the required ratings.
7. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 2.1 kPa (45 psf) at eave overhang and 1.4 kPa (30 psf) for other roof areas.

**G. Cutting and Fitting:**

1. Cut all metal deck units to proper length in the shop prior to shipping.
2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the Structural Drawings.
3. Other penetrations shown on the approved metal deck shop drawings but not shown on the Structural Drawings are to be located, cut and reinforced by the trade requiring the opening.
4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the Resident Engineer. Provide any additional reinforcing or framing required for the opening at no cost to the Government. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.
6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

**3.2 WELDING:**

Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.3.

**SECTION 05 31 00  
STEEL DECKING**

**3.3 FIELD REPAIR:**

1. Areas scarred during erection.
2. Welds to be thoroughly cleaned and touched-up. Touch-up paint for zinc-coated units shall be zinc rich galvanizing repair paint.

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**SECTION 05 36 00  
COMPOSITE METAL DECKING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies material and services required for installation of composite steel decking including shear connector studs and miscellaneous closures required to prepare deck for concrete placement as shown and specified.

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Section 03 10 00, CONCRETE FORMING AND ACCESSORIES.
- C. Section 03 20 00, CONCRETE REINFORCING.
- D. Section 03 30 00, CAST-IN-PLACE CONCRETE.
- E. Section 05 12 00, STRUCTURAL STEEL FRAMING.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and information necessary to complete the installation as shown and specified, including supplementary framing, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying structural characteristics as specified herein.
- D. Manufacturer's written recommendations for:
  - 1. Shape of decking section to be used.
  - 2. Cleaning of steel decking prior to concrete placement.
- E. Test Report - Establishing structural characteristics of composite concrete and steel decking system.
- F. Test Report - Stud base qualification.
- G. Welding power setting recommendation by shear stud manufacturer.

**SECTION 05 36 00**  
**COMPOSITE METAL DECKING**

- H. Shear Stud Layouts: Submit drawings showing the number, pattern, spacing and configuration of the shear studs for each beam and girder.
- I. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a "Steel Floor and Form Unit".

**1.4 QUALITY ASSURANCE:**

Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.

**1.5 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced.  
Publications are referenced in text by basic designation only. Refer to the latest edition of all referenced Standards and codes.
- B. American Iron and Steel Institute (AISI):  
Specification and Commentary for the Design of Cold-Formed Steel Structural Members (Latest Edition).
- C. American Society of Testing and Materials (ASTM):  
A36/A36M-08.....Standard Specification for Carbon Structural Steel  
A108-07 .....Standard Specification for Steel Bars, Carbon, Cold  
Finished, Standard Quality  
A653/A653M-10.....Standard Specification for Steel Sheet, Zinc-Coated  
(Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by  
the Hot-Dip Process
- D. American Institute of Steel Construction (AISC):
  - 1. AISC 303-05.....Code of Standard Practice for Steel Buildings and Bridges.
  - 2. AISC 360-05.....Specification for Structural Steel Buildings
- E. American Welding Society (AWS):  
D1.1/D1.1M-10.....Structural Welding Code - Steel  
D1.3/D1.3M-08.....Structural Welding Code - Sheet Steel
- F. Military Specifications (Mil. Spec.):  
MIL-P-21035B .....Paint, High Zinc Dust Content, Galvanizing Repair

**SECTION 05 36 00  
COMPOSITE METAL DECKING**

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. Steel Decking and all Flashings: ASTM A653, Structural Quality suitable for shear stud weld-through techniques.
- B. Galvanizing: ASTM A653, G60.
- C. Shear connector studs: ASTM A108, Grades 1015-1020, yield 350 Mpa (50,000 psi) minimum, tensile strength - 400 Mpa (60,000 psi) minimum, reduction of area 50 percent minimum. Studs of uniform diameter; heads shall be concentric and normal to shaft; stud, after welding free from any substance or defect which would interfere with its function as a shear connector. Studs shall not be painted or galvanized. Size of studs shall be as shown on drawings. Studs manufactured by a company normally engaged in the manufacture of shear studs and can furnish equipment suitable for weld-through installation of shear studs.
- D. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Welding Electrode: E60XX minimum.
- G. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:
  - 1. Unless otherwise noted on Structural Drawings, Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
  - 2. Unless otherwise noted on Structural Drawings, Continuous sheet metal edging: at openings and concrete slab edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.
  - 3. Unless otherwise noted on Structural Drawings, Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet

**SECTION 05 36 00  
COMPOSITE METAL DECKING**

steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.

4. Unless otherwise noted on Structural Drawings, Seat angles for deck: Where a beam does not frame into a column.

**2.2 REQUIREMENTS:**

- A. Steel decking depth, gage, and section properties to be as shown. Provide edges of deck with vertical interlocking male and female lip providing for a positive mechanical connection.
- B. Fabricate deck units with integral embossments to provide mechanical bond with concrete slab. In combination with concrete slab, capable of supporting total design loads on spans shown.
- C. Steel decking capable of safely supporting total, normal construction service loads without damage to decking unit.
- D. Provide vented deck as shown.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verify existing conditions prior to beginning work.

**3.2 ERECTION:**

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.
- D. Erect steel deck in accordance with manufacturer's printed instructions.
- E. Ship steel deck units to project in standard widths and cut to proper length.
- F. Provide steel decking in sufficient lengths to extend over 3 or more spans.



**SECTION 05 36 00**  
**COMPOSITE METAL DECKING**

- G. Unless otherwise noted on Structural Drawings, place steel decking units at right angles to supporting members. End laps of sheets shall be a minimum of 50 mm (2 inches) and shall occur over supports.
- H. Unless otherwise noted on Structural Drawings, where deck changes direction, install 6 inch (150 mm) minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches (300 mm) on center maximum.
- I. Secure decking units to supporting members by welds as shown.
- J. Longitudinal joints shall be locked mechanically as shown.
- K. On steel supports provide minimum 1-1/2 inch (38 mm) bearing.
- L. Unless otherwise noted on Structural Drawings, at openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- M. Weld stud shear connectors through steel deck to structural members below.
- N. Welding to conform to AWS D1.3 and done by competent experienced welding mechanics.
- O. Areas scarred during erection and welds shall be thoroughly cleaned and touched-up with zinc rich galvanizing repair paint. Paint touch-up is not required for welds or scars that are to be in direct contact with concrete.
- P. Provide metal concrete stops at edges of deck as required.
- Q. Cutting and Fitting:
  - 1. Cut all metal deck units to proper length in the shop prior to shipping.
  - 2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the structural drawings.
  - 3. Other penetrations shown on the approved metal deck shop drawings but not shown on the structural drawings are to be located, cut and reinforced by the trade requiring the opening.
  - 4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.

**SECTION 05 36 00**  
**COMPOSITE METAL DECKING**

5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the Resident Engineer. Provide any additional reinforcing or framing required for the opening at no cost to the Government. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.
  6. Unless otherwise noted on the Structural Drawings, Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.
- R. Installation of shear connector studs through previously installed metal deck to conform to AWS D1.1, Section 7, except all studs will be installed with automatically timed welding equipment and as specified below:
1. Do not place reinforcing steel temperature mesh or other materials and equipment which will interfere with stud installation on steel deck until shear connector studs are installed.
  2. Steel deck sheets shall be free of oil, rust, dirt, and paint. Release water in deck's valley so that it does not become entrapped between deck and beam. Surface to which stud is to be welded shall be clean and dry.
  3. Rest metal deck tightly upon top flange of structural member with bottom of deck rib in full contact with top of beam flange.
  4. Weld studs only through a single thickness of deck. Place decking so that a butt joint is obtained. Place studs directly over beam web, where one row of studs are required.
  5. Ferrules specially developed for the weld-through technique must be used. Ferrules shall be appropriate for size of studs used and be removed after welding.
  6. Submit report of successful test program for stud base qualification as required by AWS D1.1, Appendix K.

**SECTION 05 36 00  
COMPOSITE METAL DECKING**

**3.3 CLEANING:**

Clean deck in accordance with manufacturer's recommendation before concrete placement.

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**SECTION 05 40 00  
COLD-FORMED METAL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies materials and services required for installation of cold-formed steel, including tracks and required accessories as shown and specified. This Section includes the following:
  - 1. Exterior load-bearing steel stud walls.
  - 2. Interior load-bearing steel stud walls.
  - 3. Exterior non-load-bearing steel stud curtain wall.
  - 4. Steel joists.

**1.2 RELATED WORK:**

- A. Structural steel framing: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Non-load-bearing metal stud framing assemblies: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- C. Gypsum board assemblies: Section 09 29 00, GYPSUM BOARD.

**1.3 DESIGN REQUIREMENTS:**

- A. Design steel in accordance with American Iron and Steel Institute Publication "Specification for the Design of Cold-Formed Steel Structural Members", except as otherwise shown or specified.
- B. Structural Performance: Engineer, fabricate and erect cold-formed metal framing with the minimum physical and structural properties indicated.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing steel unit layout, connections to supporting members, and information necessary to complete installation as shown and specified.
- C. Manufacturer's Literature and Data: Showing steel component sections and specifying structural characteristics.
- D. For cold-formed metal framing indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for its preparation.

**SECTION 05 40 00  
COLD-FORMED METAL FRAMING**

**1.4 SUBMITTALS: (CONT)**

- E. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.5 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Iron and Steel Institute (AISI):  
Specification and Commentary for the Design of Cold-Formed Steel Structural Members (1996)
- C. American Society of Testing and Materials (ASTM):  
A36/A36M-08.....Standard Specifications for Carbon Structural Steel  
A123/A123M-09.....Standard Specifications for Zinc (Hot-Dip Galvanized)  
Coatings on Iron and Steel Products  
A153/A153M-09.....Standard Specifications for Zinc Coating (Hot-Dip) on Iron  
and Steel Hardware  
A307-10.....Standard Specifications for Carbon Steel Bolts and Studs  
A653/A653M-10.....Standard Specifications for Steel Sheet, Zinc-Coated  
(Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by  
the Hot-Dip Process  
C1107/C1107M-08 .....Standard Specifications for Packaged Dry, Hydraulic-  
Cement Grout (Non-shrink)  
E488-96(R2003) .....Standard Test Methods for Strength of Anchors in  
Concrete and Masonry Elements  
E1190-95(R2007) .....Standard Test Methods for Strength of Power-Actuated  
Fasteners Installed in Structural Members
- D. American Welding Society (AWS):  
D1.3/D1.3M-08.....Structural Welding Code-Sheet Steel

**SECTION 05 40 00**  
**COLD-FORMED METAL FRAMING**

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. Sheet Steel for joists, studs and accessories 16 gage and heavier: ASTM A653, structural steel, zinc coated G60 a yield of 340 MPa (50 ksi) minimum.
- B. Galvanizing Repair Paint: MIL-P-21035B.

**2.1 MATERIALS: (CONT)**

- C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, with fluid consistency and a 30 minute working time.

**2.2 WALL FRAMING:**

- A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, and complying with the following:
  - 1. Design Uncoated-Steel Thickness:
    - 0.91 mm (0.0358 inch) (20ga.)
    - 1.20 mm (0.0474 inch) (18ga.)
  - 2. Flange Width:(1-5/8 inches)
  - 3. Web: Punched
- B. Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following:
  - 1. Design Uncoated-Steel Thickness: Matching steel studs.
  - 2. Flange Width: Manufacturer's standard deep flange where indicated, standard flange elsewhere.

**2.3 JOIST FRAMING:**

- A. This section excludes the joist framing over the entry vestibule. See Construction Drawings
- B. Steel Joists: Manufacturer's standard C-shaped steel joists, unpunched, of web depths indicated, with lipped flanges, and complying with the following:
  - 1. Design Uncoated-Steel Thickness:
    - 1.52 mm (0.0598 inch)(18ga), 1.90 mm 0.0747 inch)(16ga), 2.66 mm (0.1046 inch)(12ga).
  - 2. Flange Width: 41 mm (1 5/8 inches) minimum. 51 mm (2 inches).

**SECTION 05 40 00**  
**COLD-FORMED METAL FRAMING**

**2.3 JOIST FRAMING: (CONT)**

- C. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, unpunched, of web depths indicated, with straight flanges, and complying with the following:
  - 1. Design Uncoated-Steel Thickness: Matching steel joists.
  - 2. Flange Width: 41 mm (1 5/8-inches) minimum. 51 mm (2 inches).

**2.4 FRAMING ACCESSORIES:**

- A. Fabricate steel framing accessories of same material and finish used for framing members, with minimum yield strength of 230 MPa (33 ksi).
- B. Accessories of manufacturer's standard thickness and configuration, as follows:
  - 1. Supplementary framing.
  - 2. Bracing, bridging, and solid blocking.
  - 3. Web stiffeners.
  - 4. Gusset plates.
  - 5. Deflection track and vertical slide clips.
  - 6. Stud kickers and girts.
  - 7. Joist hangers and end closures.
  - 8. Reinforcement plates.

**2.5 ANCHORS, CLIPS, AND FASTENERS:**

- A. Steel Shapes and Clips: ASTM A36, zinc coated by the hot-dip process, ASTM A123.
- B. Cast-in-Place Anchor Bolts and Studs: ASTM A307, Grade A, zinc coated by the hot-dip process according to ASTM A153.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws. Low-profile head beneath sheathing, manufacturer's standard elsewhere.



**SECTION 05 40 00  
COLD-FORMED METAL FRAMING**

**2.6 REQUIREMENTS:**

- A. Welding in accordance with AWS D1.3
- B. Furnish members and accessories by one manufacturer only.

**PART 3 - EXECUTION**

**3.1 FABRICATION:**

- A. Framing components may be preassembled into panels. Panels shall be square with components attached.
- B. Cut framing components squarely or as required for attachment. Cut framing members by sawing or shearing; do not torch cut.
- C. Hold members in place until fastened.
- D. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
  - 1. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
  - 2. Locate mechanical fasteners and install according to cold-formed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
- E. Where required, provide specified insulation in double header members and double jamb studs which will not be accessible after erection.

**3.2 ERECTION:**

- A. Handle and lift prefabricated panels in a manner as to not distort any member.
- B. Securely anchor tracks to supports as shown.
- C. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.
- D. Plumb, align, and securely attach studs to flanges or webs of both upper and lower tracks.
- E. All axially loaded members shall be aligned vertically to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections.
- F. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.
- G. Install headers in all openings that are larger than the stud spacing in that wall.
- H. Attach bridging for studs in a manner to prevent stud rotation. Space bridging rows as shown.

**SECTION 05 40 00  
COLD-FORMED METAL FRAMING**

**3.2 ERECTION: (CONT)**

- I. Studs in one piece for their entire length, splices will not be permitted.
- J. Provide a load distribution member at top track where joist is not located directly over bearing stud.
- K. Provide joist bridging and web stiffeners at reaction points where shown.

**3.2 ERECTION: (CONT)**

- L. Provide end blocking where joist ends are not restrained from rotation.
- M. Provide an additional joist under parallel partitions, unless otherwise shown, when partition length exceeds one-half joist span and when floor and roof openings interrupt one or more spanning members.
- N. Provide temporary bracing and leave in place until framing is permanently stabilized.
- O. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.
- P. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

**3.3 TOLERANCES:**

- A. Vertical alignment (plumbness) of studs shall be within 1/960th of the span.
- B. Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths.
- C. Spacing of studs shall not be more than 3 mm (1/8 inch) +/- from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.
- D. Prefabricated panels shall be not more than 3 mm (1/8 inch) +/- out of square within the length of that panel.

**3.4 FIELD REPAIR:**

Touch-up damaged galvanizing with galvanizing repair paint.

- - - E N D - - -

**SECTION 05 50 00  
METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
  - 1. Loose Lintels
  - 2. Shelf Angles
  - 3. Railings
  - 4. Grating

**1.2 RELATED WORK**

- A. Railings attached to steel stairs: Section 05 51 00, METAL STAIRS.
- B. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Prime and finish painting: Section 09 91 00, PAINTING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Grating
- C. Shop Drawings:
  - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
  - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
  - 3. Provide templates and rough-in measurements as required.
- D. Manufacturer's Certificates:
  - 1. Finish as specified.
  - 2. Live load designs as specified.
- E. Design Calculations for specified live loads including dead loads.
- F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.
- G. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**SECTION 05 50 00  
METAL FABRICATIONS**

**1.4 QUALITY ASSURANCE**

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type shall be the same and be made by the same manufacturer.
- C. Assembled product to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A36/ A36M-08.....Structural Steel
  - A53-10.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
  - A123-09.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - A307-10.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
  - A653/ A653M-10.....Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
  - A786/ A786M-09.....Rolled Steel Floor Plate
  - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - F436-10.....Hardened Steel Washers
  - F468-10.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
  - F1667-11.....Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
  - D1.1-10.....Structural Welding Code Steel
  - D1.2-08.....Structural Welding Code Aluminum
  - D1.3-08.....Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
  - AMP 521-01.....Pipe Railing Manual
  - AMP 500-06.....Metal Finishes Manual
- F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:
  - SP 1-04.....No. 1, Solvent Cleaning
  - SP 2-04.....No. 2, Hand Tool Cleaning
  - SP 3-04.....No. 3, Power Tool Cleaning

**PART 2 - PRODUCTS**

**2.1 DESIGN CRITERIA**

- A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.
- B. Railings and Handrails: 900 N (200 pounds) in any direction at any point.

**SECTION 05 50 00  
METAL FABRICATIONS**

**2.2 MATERIALS**

- A. Structural Steel: ASTM A36.
- C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
- D. Steel Pipe: ASTM A53.
  - 1. Galvanized for exterior locations.
  - 2. Type S, Grade A unless specified otherwise.
  - 3. NPS (inside diameter) as shown.

**2.2 MATERIALS (CONT)**

- E. Primer Paint: As specified in Section 09 91 00, PAINTING.
- F. Grout: ASTM C1107, pourable type.
- G. Insect Screening: ASTM D3656.

**2.3 HARDWARE**

- A. Rough Hardware:
  - 1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
  - 2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.
- B. Fasteners:
  - 1. Bolts with Nuts:
    - a. ASME B18.2.2.
    - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
    - c. ASTM F468 for nonferrous bolts.
  - 2. Screws: ASME B18.6.1.
  - 3. Washers: ASTM F436, type to suit material and anchorage.
  - 4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

**2.4 FABRICATION GENERAL**

- A. Material
  - 1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
  - 2. Use material free of defects which could affect the appearance or service ability of the finished product.
- B. Size:
  - 1. Size and thickness of members as shown.
  - 2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.
- C. Connections
  - 1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
  - 2. Field riveting will not be approved.

**SECTION 05 50 00  
METAL FABRICATIONS**

**2.4 FABRICATION GENERAL (CONT)**

3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
  4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
  5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
  6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
- D. Fasteners and Anchors
1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
  2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
  3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
  4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
- E. Workmanship
1. General:
    - a. Fabricate items to design shown.
    - b. Furnish members in longest lengths commercially available within the limits shown and specified.
    - c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
    - d. Prepare members for the installation and fitting of hardware.
    - e. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
  2. Welding:
    - a. Weld in accordance with AWS.
    - b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
    - c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
    - d. Finish welded joints to match finish of adjacent surface.
  3. Joining:
    - a. Miter members at corners.
  4. Cutting and Fitting:
    - a. Accurately cut, machine and fit joints, corners, copes, and miters.
    - b. Fit removable members to be easily removed.
    - c. Design and construct field connections in the most practical place for appearance and ease of installation.

**SECTION 05 50 00  
METAL FABRICATIONS**

**2.4 FABRICATION GENERAL (CONT)**

- d. Fit pieces together as required.
- e. Fabricate connections for ease of assembly and disassembly without use of special tools.
- f. Joints firm when assembled.
- g. Conceal joining, fitting and welding on exposed work as far as practical.
- h. Do not show rivets and screws prominently on the exposed face.
- F. Finish:
  - 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
  - 2. Aluminum: NAAMM AMP 501.
    - a. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
    - b. Painted: AA-C22R10.
  - 3. Steel and Iron: NAAMM AMP 504.
    - a. Surfaces exposed in the finished work:
      - 1) Finish smooth rough surfaces and remove projections.
    - b. Shop Prime Painting:
      - 1) Surfaces of Ferrous metal:
        - a) Items not specified to have other coatings.
        - b) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
        - c) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
        - d) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
      - 2) Non ferrous metals: Comply with MAAMM-500 series.
- G. Protection:
  - 1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.

**2.5 SUPPORTS**

- A. General:
  - 1. Fabricate ASTM A36 structural steel shapes as shown.
  - 2. Field connections may be welded or bolted.
- B. For Ceiling Hung Toilet Stall:
  - 1. Use a continuous steel channel above pilasters with hangers centered over pilasters.
  - 2. Make provision for installation of stud bolts in lower flange of channel.
- C. For Wall Mounted Items:
  - 1. For items supported by metal stud partitions.
  - 2. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
  - 3. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.

**SECTION 05 50 00  
METAL FABRICATIONS**

**2.7 LOOSE LINTELS**

- A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.
- B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.

**2.8 SHELF ANGLES**

- A. Fabricate from steel angles of size shown.
- B. Fabricate angles with horizontal slotted holes for 19 mm (3/4 inch) bolts spaced at not over 900 mm (3 feet) on centers and within 300 mm (12 inches) of ends.

**2.9 RAILINGS**

- A. In addition to the dead load design railing assembly to support live load specified.
- B. Fabrication General:
  - 1. Provide continuous welded joints, dressed smooth and flush.
  - 2. Standard flush fittings, designed to be welded, may be used.
  - 3. Form handrail brackets to size and design shown.
  - 4. Exterior Post Anchors.
    - a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
  - 5. Interior Post Anchors:
    - a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
- C. Handrails:
  - 1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
  - 2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.
- D. Steel Pipe Railings:
  - 1. Fabricate of steel pipe with welded joints.
  - 2. Number and space of rails as shown.
  - 3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
  - 4. Form handrail brackets from malleable iron.
    - a. Continuously weld brackets to post.
    - b. Provide slotted bolt holes in rail bracket.
    - c. Weld bolt heads flush with top of rail.
    - d. Weld flanged fitting to post where posts are installed in sleeves.

**2.10 GRATING**

- A. Style: Rectangular Bar Type locked by welding
  - 1. Construct in 2 sections
- B. Bearing Bar: 2" x 3/16" at 1 3/16" o.c.
- C. Cross Bars-1/4" square twisted at 4" o.c.
- D. Size: 3'-0" x 7'-9" OA
- E. Finish: Galvanized
- E. Live Load: 80psf



**SECTION 05 50 00  
METAL FABRICATIONS**

**2.10 GRATING (Cont)**

- F. Span: 2'-8"
- H. Accessories:
  - 1. Removable clips to tie sections together
  - 2. Removable clips to hold grating in place

**PART 3 - EXECUTION**

**3.1 INSTALLATION, GENERAL**

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
  - 1. Provide temporary bracing for such items until concrete is set.
  - 2. Place in accordance with setting drawings and instructions.
- C. Set frames flush with finish wall surface and, where applicable, flush with side of opening.
- D. Field weld in accordance with AWS.
  - 1. Design and finish as specified for shop welding.
  - 2. Use continuous weld unless specified otherwise.
- E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified.
- F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.
- G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.
- H. Secure escutcheon plate with set screw.

**3.2 INSTALLATION OF SUPPORTS**

- A. Anchorage to structure.
  - 1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
  - 2. Secure steel plate or hat channels to studs as detailed.
- B. Ceiling Hung Toilet Stalls:
  - 1. Securely anchor hangers of continuous steel channel above pilasters to structure above.
  - 2. Bolt continuous steel angle at wall to masonry or weld to face of
- C. Supports for Wall Mounted items:
  - 1. Locate center of support at anchorage point of supported item.
  - 2. Locate support at top and bottom of wall hung cabinets.
  - 3. Locate support at top of floor cabinets and shelving installed against walls.
  - 4. Locate supports where required for items shown.
- D. Support for grab bars:
  - 1. Locate channels or tube in partition for support as shown, and extend full height from floor to underside of structure above.
  - 2. Anchor at top and bottom

**SECTION 05 50 00  
METAL FABRICATIONS**

**3.3 GUARDS**

- A. Security Screens:
  - 1. Follow Manufacturers installation instructions
  - 2. Locate where shown on drawings
  - 3. Fasten to adjoining construction with fasteners as indicated by Manufacturer.

**3.4 STEEL LINTELS**

- A. Use lintel sizes and combinations shown or specified.
- B. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

**3.6 SHELF ANGLES**

- A. Anchor shelf angles with 19 mm (3/4 inch) bolts unless shown otherwise in adjustable malleable iron inserts, set level at elevation shown.
- B. Provide expansion space at end of members.

**3.7 RAILINGS**

- A. Steel Posts:
  - 1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.
  - 2. Install sleeves in concrete formwork.
  - 3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS-on exterior posts.
  - 4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
  - 5. Secure sliding flanged fittings to posts at base with set screws.
  - 6. Secure fixed flanged fittings to concrete with expansion bolts.
  - 7. Secure posts to steel with welds.
- B. Handrails:
  - 1. Anchor brackets for metal handrails as detailed.
  - 2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
  - 3. Expansion bolt to concrete or solid masonry.
  - 4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

**3.8 GRATING**

Install grating, loose lay in recessed frame as detailed

**3.9 STEEL COMPONENTS FOR MILLWORK ITEMS**

Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

**SECTION 05 50 00  
METAL FABRICATIONS**

**3.10 CLEAN AND ADJUSTING**

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

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**SECTION 05 51 00  
METAL STAIRS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies steel stairs with railings.
- B. Types:
  - 1. Industrial stairs: Closed riser stairs.

**1.2 RELATED WORK**

- A. Wall handrails and railings for other than steel stairs: Section 05 50 00, METAL FABRICATIONS.
- B. Requirements for shop painting: Section 09 91 00, PAINTING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design, fabrication details, installation, connections, material, and size of members.
- C. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.4 APPLICATION PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation.
- B. American Society for Testing and Materials (ASTM):
  - A36/ A36M-08.....Structural Steel
  - A53-10.....Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
  - A307-10.....Carbon Steel Bolts and Studs, 60000 psi Tensile Strength
  - A653/ 653M-10.....Steel Sheet, Zinc Coated (Galvanized) or Zinc Alloy Coated (Galvannealed) by the Hot-Dip Process
  - A563-07.....Carbon and Alloy Steel Nuts
  - A1008-10.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low-Alloy
  - A786/ A786M-09.....Rolled Steel Floor Plates
- C. American Welding Society (AWS):
  - D1.1-10.....Structural Welding Code-Steel
  - D1.3-08.....Structural Welding Code-Sheet Steel

**SECTION 05 51 00  
METAL STAIRS**

**1.4 APPLICATION PUBLICATIONS (CONT)**

- D. The National Association of Architectural Metal Manufacturers (NAAMM) Manuals:  
Metal Bar Gratings (ANSI/NAAMM MBG 531-09)  
AMP521-01.....Pipe Railing Manual, Including Round Tube
- E. American Iron and Steel Institute (AISI):  
2001 .....Design of Cold-Formed Steel Structural Members

**PART 2 - PRODUCTS**

**2.1 DESIGN CRITERIA**

- A. Design stairs to support a live load of 500 kg/m<sup>2</sup> (100 pounds per square foot).
- B. Structural design, fabrication and assembly in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.
- C. Design pipe railings in accordance with NAAMM Pipe Railing Manual for 900 N (200 pounds) or 50 pounds per linear foot in any direction at any point.

**2.2 MATERIALS**

- A. Steel Pipe: ASTM A53, Standard Weight, zinc coated.
- B. Steel Grating: Metal bar type grating NAAMM BG.
- C. Sheet Steel: ASTM A1008.
- D. Structural Steel: ASTM A36.
- E. Steel Floor Plate: ASTM 786.
- F. Steel Plate: ASTM A1011.
- G. Iron Castings: ASTM A48, Class 30.
- H. Malleable Iron Castings: ASTM A47.

**2.3 FABRICATION GENERAL**

- A. Fasteners:
  - 1. Conceal bolts and screws wherever possible.
  - 2. Use countersunk heads on exposed bolts and screws with ends of bolts and screws dressed flush after nuts are set.
- B. Welding:
  - 1. Structural steel, AWS D1.1 and sheet steel, AWS D1.3.
  - 2. Where possible, locate welds on unexposed side.
  - 3. Grind exposed welds smooth and true to contour of welded member.
  - 4. Remove welding splatter.
- C. Remove sharp edges and burrs.
- D. Fit stringers to head channel and close ends with steel plates welded in place where shown.
- E. Fit face stringer to newel post by tenoning into newel post, or by notching and fitting face stringer to side of newel where shown.
- F. Shop Prime Painting: Prepare surface and apply primer as specified for ferrous metals in Section 09 91 00, PAINTING

**SECTION 05 51 00  
METAL STAIRS**

**2.4 RAILINGS**

- A. Fabricate railings, including handrails, from steel pipe with flush.
  - 1. Connections may be standard fittings designed for welding, or coped or mitered pipe with full welds.
- B. Return ends of handrail to wall and close free end.
- C. Provide standard terminal castings where fastened to newel.
- D. Space intermediate posts not over six feet on center between end post
- E. Fabricate handrail brackets from cast malleable iron.
- F. Provide standard terminal fittings at ends of post and rails.

**2.5 OPEN RISER STAIRS**

- A. Provide treads, risers, platforms, railings, stringers, headers and other supporting members.
- B. Fabricate or provide treads and platforms, from preformed, slotted rough grip type steel units
- D. Fabricate stringers, headers, and other supporting members from structural steel.

**PART 3 - EXECUTION**

**3.1 STAIR INSTALLATION**

- A. Provide hangers and struts required to support the loads imposed.
- B. Perform job site welding and bolting as specified for shop fabrication.
- C. Set stairs and other members in position and secure to structure as shown.
- D. Install stairs plumb, level and true to line.
- E. Provide steel closure plate to fill any gap between the stringer and surrounding shaft wall. Weld and finish with prime and paint finish of adjoining steel.

**3.2 RAILING INSTALLATION**

- A. Install standard terminal fittings at ends of posts and rails.
- B. Secure brackets, posts and rails to steel by welds, and to masonry or concrete with expansion sleeves and bolts, except secure posts at concrete by setting in sleeves filled with commercial non-shrink grout.
- C. Set rails horizontal or parallel to rake of stairs to within 3 mm in 3650 mm (1/8-inch in 12 feet).
- D. Set posts plumb and aligned to within 3 mm in 3650 mm (1/8-inch in 12 feet).

**3.3 FIELD PRIME PAINTING**

- A. When installation is complete, clean field welds and surrounding areas to bright metal, and coat with same primer paint used for shop priming.
- B. Touch-up abraded areas with same primer paint used for shop priming.
- C. Touch up abraded galvanized areas with zinc rich paint as specified in section 09 91 00, PAINTING.

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**SECTION 06 10 00  
ROUGH CARPENTRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Section sheathing, rough hardware, and light wood construction.

**1.2 RELATED WORK:**

- A. Cement board sheathing: Section 06 16 63, CEMENTITIOUS SHEATHING.

**1.3 PRODUCT DELIVERY, STORAGE AND HANDLING:**

- A. Protect products from dampness both during and after delivery at site.
- B. Stack plywood and other board products so as to prevent warping.
- C. Locate stacks on well drained areas, supported at least 150 mm (6 inches) above grade and cover with well ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

**1.4 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Plywood Association (APA):
  - E30-07.....Engineered Wood Construction Guide
  - D1760-01.....Pressure Treatment of Timber Products
  - D2559-10.....Adhesives for Structural Laminated Wood Products for Use  
Under Exterior (Wet Use) Exposure Conditions
  - F1667-08.....Nails, Spikes, and Staples
- C. Commercial Item Description (CID):
  - A-A-55615 .....Shield, Expansion (Wood Screw and Lag Bolt Self  
Threading Anchors)
- D. Military Specification (Mil. Spec.):
  - MIL-L-19140E .....Lumber and Plywood, Fire-Retardant Treated
- E. U.S. Department of Commerce Product Standard (PS)
  - PS 1-95.....Construction and Industrial Plywood
  - PS 20-05.....American Softwood Lumber Standard

**PART 2 - PRODUCTS**

**2.1 LUMBER:**

- A. Miscellaneous:
  - 1. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.
- B. Fire Retardant Treatment:
  - 1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
- C. Preservative Treatment:
  - 1. Treat wood members and plywood exposed to weather or in contact with masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 600 mm (24 inches) from ground; nailers, edge strips,

**SECTION 06 10 00  
ROUGH CARPENTRY**

**2.1 LUMBER: (CONT)**

- blocking, and other members used in connection with roofing and flashing materials.
- 2. Treat other members specified as preservative treated (PT).
- 3. Preservative treat by the pressure method complying with ASTM D1760, except any process involving the use of Chromated Copper arsenate (CCA) for pressure treating wood is not permitted.

**2.2 PLYWOOD**

- A. Comply with Prod. Std., PS 1.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
- C. Sheathing:
  - 1. APA rated Exposure 1 or Exterior; panel grade CD or better.
  - 2. Wall sheathing:
    - a. Minimum 9 mm (17/32 inch) thick with supports 400 mm (16 inches) on center.
    - b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.
    - c. Meets AWWA U1 for above ground exterior fire protection and AWWA C20/C27 for exterior type, Fire retardant treated lumber

**2.3 EXTERIOR DRAINAGE MAT SYSTEM**

- A. Exterior wall Drainage Mat: Randomly oriented geometric patterned drainage and ventilation mat designed to eliminate moisture and moisture vapor in wall applications.
  - 1. Physical Characteristics: Three-dimensional mat heat laminated to a non-woven lightweight, vapor permeable fabric. The monofilament mat is heat welded at the junctions to form a resilient structure that isolates veneer from the back-up.
    - a. 0.25 inches (6 mm) thick.
    - b. 12.7 oz/sq. yd. (431 g/sq m) total weight.
    - c. 48 inches (122 cm) wide.
    - d. 65 feet (19.8 m) roll length.
  - 2. Performance:  
Drainage of moisture and ventilation between veneer and back-up support.
  - 3. Material: UV stabilized polypropylene.  
Class A flame spread per ASTM E84.  
ASTM E 2273 - Standard Test Method for Determining the Drainage Efficiency
- B. Design Basis: Keene Driwall Rainscreen
- C. Building Wrap:
  - 1. Building Paper or House Wrap and flashing

**2.3 ROUGH HARDWARE AND ADHESIVES:**

- A. Screws:
  - 1. Wood to Steel: ASTM C954, or ASTM C1002.

**SECTION 06 10 00  
ROUGH CARPENTRY**

**PART 3 - EXECUTION**

**3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:**

- A. Conform to applicable requirements of the following:
  - 1. APA for installation of plywood or structural use panels.
- B. Fasteners:
  - 1. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
    - a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
    - b. ASTM C 954 for steel over 0.84 mm (0.033 inch) thick.
  - 2. Power actuated drive pins may be used where practical to anchor to solid masonry, concrete, or steel.
  - 3. Closely fit, and set to required lines.
- C. Cut notch, or bore in accordance with NFPA Manual for House-Framing for passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.
- D. Blocking Nailers, and Furring:
  - 1. Install furring, blocking, nailers, and grounds where shown.
  - 2. Use longest lengths practicable.
  - 3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.
- N. Sheathing:
  - 1. Use fire retardant treated plywood for sheathing.
  - 2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
  - 3. Set screws not less than 9 mm (3/8 inch) from edges.
  - 4. Install 50 mm by 100 mm (2 inch by 4 inch) blocking spiked between joists, rafters and studs to support edge or end joints of panels.
- O. Exterior Drainage System Installation :
  - 1. Install building paper or house wrap and flashing to manufacturers' recommendations. Place drainage mat horizontally against exterior wall, fabric side out, entangled core to the building interior. Start at the bottom of the wall and work up.
  - 2. Mechanically fasten with a staple hammer, large head nail or washer and screw one fastener for each square foot (0.1 sq. m). When installing over concrete or block back-up walls that do not accept mechanical fasteners hold in place with small dabs of glue every 2.0 feet (0.61 m). Do not fasten through flashing.
  - 3. Seam adjacent piece with the selvage edge overlapping the top of the lower drainage mat piece. Shingle so that selvage edge is installed toward the bottom of the wall.
  - 4. Install siding, shingle or fiber-cement siding according to manufacturers' recommendations. When choosing a fastener, allow for thickness of drainage mat. Pneumatic nail guns can be used if nails meet manufacturers' recommendations and air pressure and depth gauge is set to fasten nail snug with surface.

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**SECTION 06 20 00  
FINISH CARPENTRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies exterior and interior millwork.
- B. Items specified.
  - Cabinetry
  - Counter or Work Tops
  - Chair Rail
  - Resin Panels

**1.2 RELATED WORK**

- A. Fabricated Metal brackets, bench supports and countertop legs: Section 05 50 00, METAL FABRICATIONS.
- B. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.
- C. Wood doors: Section 08 14 00, WOOD DOORS.
- D. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES.
- E. Other Countertops: Division 11, EQUIPMENT and Division 12, FURNISHINGS.
- F. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Millwork items – Quarter full size scale for sections and details (3/8-inch) for elevations and plans.
  - 2. Show construction and installation.
- C. Samples:
  - Plastic laminate finished plywood or particleboard, 150 mm by 300 mm (six by twelve inches).
- D. List of acceptable sealers for fire retardant and preservative treated materials.
- E. Manufacturer's literature and data:
  - 1. Finish hardware
  - 2. Sinks with fittings
  - 3. Electrical components
- F. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**SECTION 06 20 00  
FINISH CARPENTRY**

**1.4 DELIVERY, STORAGE AND HANDLING**

- A. Protect lumber and millwork from dampness, maintaining moisture content specified both during and after delivery at site.
- B. Store finishing lumber and millwork in weathertight well ventilated structures or in space in existing buildings designated by Resident Engineer. Store at a minimum temperature of 21°C (70°F) for not less than 10 days before installation.
- C. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Testing and Materials (ASTM):  
E84-09.....Surface Burning Characteristics of Building Materials
- C. American Hardboard Association (AHA):  
A135.4-04.....Basic Hardboard
- D. Builders Hardware Manufacturers Association (BHMA):  
A156.9-03.....Cabinet Hardware  
A156.11-04.....Cabinet Locks  
A156.16-02.....Auxiliary Hardware
- E. National Particleboard Association (NPA):  
A208.1-99.....Wood Particleboard
- H. Architectural Woodwork Institute (AWI):  
AWI-99.....Architectural Woodwork Quality Standards and Quality  
Certification Program
- I. National Electrical Manufacturers Association (NEMA):  
LD 3-05.....High-Pressure Decorative Laminates
- J. Federal Specifications (Fed. Spec.):  
A-A-1936.....Contact Adhesive  
FF-N-836D.....Nut, Square, Hexagon Cap, Slotted, Castle  
FF-S-111D(1).....Screw, Wood  
MM-L-736(C).....Lumber, Hardwood

**PART 2 - PRODUCTS**

**2.1 LUMBER**

- A. Grading and Marking:
  - 1. Lumber shall bear the grade mark, stamp, or other identifying marks indicating grades of material.
- B. Sizes:
  - 1. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which product is produced.
  - 2. Millwork, standing and running trim, and rails: Actual size as shown or specified.
- C. Hardwood: MM-L-736, species as specified for each item.
- D. Use edge grain Wood members exposed to weather.

**SECTION 06 20 00  
FINISH CARPENTRY**

**2.2 PLYWOOD**

- A. Softwood Plywood:
  - 1. Prod. Std.
  - 2. Grading and Marking:
    - a. Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood.
    - b. The mark shall identify the plywood by species group or identification index, and shall show glue type, grade, and compliance with PS1.
  - 3. Plywood, 13 mm (1/2 inch) and thicker; not less than five ply construction, except 32 mm (1-1/4 inch) thick plywood not less than seven ply.
  - 4. Shelving Plywood:
    - a. Interior Type, any species group.
    - b. Veneer Grade: A-B or B-C.
  - 5. Other: As specified for item.

**2.3 PARTICLEBOARD**

- A. NPA A208.1
- B. Plastic Laminate Particleboard Cores:
  - 1. Use Type 2, Grade 2-M-2, unless otherwise specified.
  - 2. Use Type 2, Grade 2-M-2, exterior bond, for tops with sinks.
- C. General Use: Type 2, Grade 2-M-2.

**2.4 PLASTIC LAMINATE**

- A. NEMA LD-3.
- B. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish. General Purpose, Type HGL.
- C. Cabinet Interiors including Shelving: Both of following options to comply with NEMA, CLS as a minimum.
  - 1. Plastic laminate clad plywood or particle board.
  - 2. Resin impregnated decorative paper thermally fused to particle board.
- D. Backing sheet on bottom of plastic laminate covered wood tops: Backer, Type HGP.

**2.5 BUILDING BOARD (HARDBOARD)**

- A. ANSI/AHA A135.4, 6 mm (1/4 inch) thick unless specified otherwise.
- B. Perforated hardboard (Pegboard): Type 1, Tempered perforated 6 mm (1/4 inch) diameter holes, on 25 mm (1 inch) centers each way, smooth surface one side.

**2.6 ADHESIVE**

- A. For Plastic Laminate: Fed. Spec. A-A-1936.
- B. For Interior Millwork: Unextended urea resin, unextended melamine resin, phenol resin, or resorcinol resin.
- C. For Exterior Millwork: Unextended melamine resin, phenol resin, or resorcinol resin.

**SECTION 06 20 00  
FINISH CARPENTRY**

**2.7 HARDWARE**

- A. Rough Hardware:
  - 1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; cadmium plated, or zinc-coated by electric-galvanizing process.
  - 2. Use galvanized coating on ferrous metal for exterior work unless non-ferrous metals or stainless is used.
  - 3. Fasteners:
    - a. Bolts with Nuts: FF-N-836.
    - b. Expansion Bolts: A-A-1922A.
    - c. Screws: Fed. Spec. FF-S-111.
- B. Finish Hardware
  - 1. Cabinet Hardware: ANSI A156.9.
    - a. Door/Drawer Pulls: B02011 (Design Basis: Stanley 4484)
    - b. Drawer Slides: B05051 for drawers over 150 mm (6 inches) deep, B05052 for drawers 75 mm to 150 mm 3 to 6 inches) deep, and B05053 for drawers less than 75 mm (3 inches) deep. (Design Basis: Accuride 3832 & 4034)
    - d. Adjustable Shelf Standards: B4061 with shelf rest B04083. (Design Basis: Knappe & Vogt 255&256)
    - e. Concealed Hinges: B1601, minimum 170 degree opening. (Design Basis: Blum)
    - f. Cabinet Door Catch: B0371 or B03172. (Design Basis: Stanley 41)
    - g. Vertical Slotted Shelf Standard: B04103 with shelf brackets B04113, sized for shelf depth. (Design Basis: Knappe & Vogt 87 & 187)
    - h. Cable Grommets: Plastic, 2 in Diameter (Design Basis: Doug Mockett TG Flip Top)
  - 2. Cabinet Locks: ANSI A156.11.
    - a. Drawers and Hinged Door: E07262. (Design Basis: Stanley 4484)

**2.8 RESIN PANELS (SW)**

- A. Thermoformed by low temperature, to create highly complex shapes and curves, panels are applied as a finish material.
- B. Panel Size: 48" x 96" or 120"
- C. Thickness/Gauge:
- D. Pattern: Linear
- E. Design Basis: Section 09 06 00, SCHEDULE FOR FINISHES

**2.9 COUNTERTOP BRACKETS**

- A. Heavy Duty 'L' bracket
  - 1. 5mm steel bar bracket with 3/4" steel strut
  - 2. Pre-drilled holes to attach to wall and bottom of countertop/shelf
  - 3. 21.7" x 14.2"
  - 4. White
  - 5. Capacity: 1000#
- B. Design Basis: Reeve RE208-22-wh



**SECTION 06 20 00  
FINISH CARPENTRY**

**2.10 MOISTURE CONTENT**

- A. Moisture content of lumber and millwork at time of delivery to site.
  - 1. Interior finish lumber, trim, and millwork 32 mm (1-1/4 inches) or less in nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
  - 2. Moisture content of other materials shall be in accordance with the standards under which the products are produced.

**2.11 FABRICATION**

- A. General:
  - 1. Except as otherwise specified, use AWI Custom Grade for architectural woodwork and interior millwork.
  - 2. Finish woodwork shall be free from pitch pockets.
  - 3. Except where special profiles are shown, trim shall be standard stock molding and members of the same species.
  - 4. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded as shown.
  - 5. Interior trim and items of millwork to be painted may be fabricated from jointed, built-up, or laminated members, unless otherwise shown on drawings or specified.
  - 6. Plastic Laminate Work:
    - a. Factory glued to a particle board core, thickness as shown or specified.
    - b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown or specified. Use plastic molded edge strips on 19 mm (3/4-inch) molded thick or thinner core material.
    - c. Provide plastic backing sheet on underside of countertops, vanity tops, thru-wall counter including back splashes and end splashes of countertops.
    - d. Use backing sheet on concealed large panel surface when decorative face does not occur.
- C. Mounting Strips, Shelves and Rods:
  - 1. Cut mounting strips from 25 mm by 100 mm (1 by 4 inches) softwood stock, with exposed edge slightly rounded.
  - 2. Plastic laminate covered, 19 mm (3/4 inch) thick plywood or particle board core with edges and ends having plastic molded edge strips. Size, finish and number as shown.
- D. Counter or Work Tops:
  - 1. Fabrication with plastic laminate over 32 mm (1-1/4 inch) thick core unless shown otherwise.
    - a. Use decorative laminate for exposed edges of tops 38 mm (1-1/2 inches) wide and on back splash and end splash. Use plastic or metal edges for top edges less than 38 mm (1-1/2 inches) wide.
    - b. Assemble back splash and end splash to counter top.
    - c. Use one piece counters for straight runs.
    - d. Miter corners for field joints with overlapping blocking on underside of joint.
- E. Wood Chair rails and Handrail:
  - 1. Fabricate from Select mixed grain Cherry
  - 2. AWI Premium Grade.
  - 3. Fabricate in one piece and one length when practical.
  - 4. Fabricate curved sections for ends of rails to return to wall and where rails change slope or direction.

**SECTION 06 20 00  
FINISH CARPENTRY**

5. Joints are permitted only where rail changes direction or slope, or where necessary for field erection or shipping.
  6. Scarf or dowel all joints to provide a smooth and rigid connection. Glue all joints.
  7. Fit joints, to produce a hair-line crack.
  8. Completely shop fabricated in accordance with approved shop drawings.
- F. Resin Panels:
1. Form per manufacturer's instructions to drawings.
  2. Attach without exposing fasteners.
  3. Seams finished and hidden or exposed as detailed.
  4. Install per manufacturer's installation instructions.

**PART 3 - EXECUTION**

**3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain work areas and storage areas to a minimum temperature of 21°C (70°F) for not less than 10 days before and during installation of interior millwork.
- B. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

**3.2 INSTALLATION**

- A. General:
  1. Millwork receiving transparent finish shall be primed and back-painted on concealed surfaces. Set no millwork until primed and back-painted.
  2. Secure trim with fine finishing nails, screws, or glue as required.
  3. Set nails for putty stopping. Use washers under bolt heads where no other bearing plate occurs.
  4. Seal cut edges of preservative and fire retardant treated wood materials with a certified acceptable sealer.
  5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
  6. Plumb and level items unless shown otherwise.
  7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.
- B. Shelves:
  1. Install mounting strip at back wall and end wall for shelves in closets where shown secured with toggle bolts at each end and not over 600 mm (24 inch) centers between ends.
    - a. Nail Shelf to mounting strip at ends and to back wall strip at not over 900 mm (36 inches) on center.

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**SECTION 06 60 00**  
**FIBERGLASS-REINFORCED PLASTIC (FRP) PANELS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Work of this Section is to provide a finish panel on walls where indicated.

**1.2 COORDINATION**

A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.3 MAINTENANCE INSTRUCTIONS**

A. Submit Instructions to General Contractor for inclusion in Owner's Maintenance Manual.

**1.4 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Deliver in unbroken Packages with Manufacturer's legible Label thereon. Do not remove Labels or open Packages until Architect inspects and approves.
- B. Store in clean and dry Storage Area.
- C. Protect against damage and discoloration.
- D. 24 hours prior to application, remove Panels from package and allow Panels to acclimatize to Installation Area Temperature and Humidity.

**1.5 EXTRA STOCK**

- A. Provide 1 extra unopened case of each color and type of Panels.
- B. Store on Project Premises where directed by Owner.

**PART 2 - PRODUCTS**

**2.1 PANELS**

- A. Material: Fiberglass-reinforced Plastic (FRP)
- B. ASTM E-84 Fire Rating Class: A
- C. Surface Texture: Pebbled Embossed

**2.2 TRIM PIECES**

- A. Type: Recommended by Panel Manufacturer for conditions of use
- B. Color: Match adjacent Panels.
- C. Extent of Work: Provide at Panel edges.

**2.3 PRIMERS & ADHESIVES**

- A. Manufacturer & Brand: Contractor's choice
- B. Type: Mildew-resistant, satisfying conditions of use, and permitting removal of Panels without Substrate damage.
- C. Fire-resistiveness: No less than Panel rating.

**2.4 FASTENERS**

- A. Manufacturer: Contractor's choice
- B. Type: Concealed and satisfying conditions of use.

**SECTION 06 60 00**  
**FIBERGLASS-REINFORCED PLASTIC (FRP) PANELS**

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Panels are true, sound, clean, dust-free, mildew-free, free from conditions that could damage Panels or impair Adhesive bond, and be otherwise properly prepared.
- B. Verify that Surfaces to receive Panels do not exceed 4% Moisture content.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 PREPARATION WORK**

- A. Before applying Panels, remove any Finish Hardware, Electric Cover Plates, Mechanical Grilles or Registers, etc. which interfere with Panel application.
- B. Carefully store Removed Items, and accurately replace following Panel application.

**3.4 SURFACE PREPARATION**

- A. Remove any Substrate Surface Defects that could show through Panel surface.

**3.5 PANEL INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Except at any Color or Pattern breaks, do not install Panels with Horizontal Seams.
- C. Do not extend Panels below top of any adjacent Wall Base.
- D. Take special care to assure complete adhesion at Joints, Edges, and Corners.

**3.6 TRIM INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Install any necessary Butt Joints tight, neat, hairline, and no closer than 4 ft. apart.

**3.7 PRODUCT CLEANING & REPAIRING**

- A. Immediately remove any Adhesive from Adjacent Surfaces.
- B. Leave Surfaces clean and defect-free at time of Substantial Project Completion.
- C. Including Work of other Trades, clean, repair and touch-up, or replace when directed Products which have been soiled, discolored, or damaged by Work of this Section.
- D. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**SECTION 07 08 00**  
**FACILITY EXTERIOR CLOSURE COMMISSIONING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section apply to all sections of Division 07 and Division 08.
- B. This project will have selected building systems commissioned. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

**1.2 RELATED WORK**

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

**1.3 SUMMARY**

- A. This Section includes requirements for commissioning the Facility exterior closure, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.
- D. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

**1.4 DEFINITIONS**

- A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

**1.5 COMMISSIONED SYSTEMS**

- A. Commissioning of a system or systems specified in Division 07 and Division 08 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.
- B. The following Facility exterior closure systems will be commissioned:
  - 1. Roofs EPDM, flashing & sheet metal, roof specialties, and roof accessories)
  - 3. Curtain Wall Systems (Mullions, glazing, and sealing)
  - 4. Exterior Doors
  - 5. Exterior Windows
  - 6. Louvers and Vents
  - 7. Sealants (Caulking, mechanical seals, and wind and vapor barriers)

**1.6 SUBMITTALS**

- A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the

**SECTION 07 08 00**  
**FACILITY EXTERIOR CLOSURE COMMISSIONING**

**1.6 SUBMITTALS (CONT)**

Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

- B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 PRE-FUNCTIONAL CHECKLISTS**

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

**3.1 CONTRACTORS TESTS**

- A. Contractor tests as required by other sections of Division 07 or Division 08 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. The Commissioning Agent will witness selected Contractor tests. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

**3.2 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:**

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident

**SECTION 07 08 00**  
**FACILITY EXTERIOR CLOSURE COMMISSIONING**

**3.2 SYSTEMS FUNCTIONAL PERFORMANCE TESTING: (CONT)**

Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

**3.3 TRAINING OF VA PERSONNEL**

- A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the VA Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 21 Sections for additional Contractor training requirements.

----- END -----





**SECTION 07 11 13  
BITUMINOUS DAMPPROOFING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies materials and workmanship for bituminous dampproofing on concrete and masonry surfaces.

**1.2 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Product description.
  - 2. Application instructions.

**1.3 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - D226-06 .....Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
  - D449-03(R2008).....Asphalt Used in Dampproofing and Waterproofing
  - D1227-95(R2007).....Emulsified Asphalt Used as a Protective Coating for Roofing

**PART 2 - PRODUCTS**

**2.1 ASPHALT EMULSION (COLD APPLIED):**

- A. ASTM D1227, Type III (spray grade)
- B. ASTM C 836, Crack cycling
- C. ASTM D 903, Adhesion to Substrate
- D. ASTM D 5385 Resistance to Hydrostatic Pressure
- E. Design Basis: Grace Construction Products: Procor 75

**2.2 PROTECTION BOARD**

- A. Composite Drainage Board

**PART 3 - EXECUTION**

**3.1 SURFACE PREPARATION:**

- A. Surfaces to receive dampproofing shall be clean ,smooth and dry.
- B. Remove foreign matter, loose particles of mortar or other cementitious droppings.
- C. Clean and wash soil or dirt particles from surface.

**SECTION 07 11 13**  
**BITUMINOUS DAMPPROOFING**

**3.2 APPLICATION:**

- A. Comply with Manufacturer written instructions for methods and rates of dampproofing application, cleaning, priming and installation of any protection course.
- B. Apply each coat at the rate of not less than 1 L/m<sup>2</sup> (2-1/2 gallons per 100 square feet) and allow not less than 24 hours drying time after application.
- C. Apply protection drainage system same day as waterproofing application, bonding to membrane
- D. Follow manufacturer's recommendations for time of backfilling and methods.

**3.3 LOCATION:**

- A. Apply to surfaces where shown.

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**SECTION 07 21 13  
THERMAL INSULATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies thermal and acoustical insulation for buildings.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

**1.2 RELATED WORK**

- A. Insulation in connection with roofing: Section 07 22 00, ROOF AND DECK INSULATION.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES .
- B. Manufacturer's Literature and Data:
  - 1. Insulation, each type used
  - 2. Adhesive, each type used.
  - 3. Tape
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.

**1.4 STORAGE AND HANDLING:**

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

**1.5 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C553-08 .....Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
  - C578-08 .....Rigid, Cellular Polystyrene Thermal Insulation
  - C591-08 .....Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
  - C612-04 .....Mineral Fiber Block and Board Thermal Insulation
  - E84-08.....Surface Burning Characteristics of Building Materials
  - F1667-05.....Driven Fasteners: Nails, Spikes and Staples.

**PART 2 - PRODUCTS**

**2.1 INSULATION - GENERAL:**

- A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.
- B. Where "R" value is not specified for insulation, use the thickness shown on the drawings.

**SECTION 07 21 13  
THERMAL INSULATION**

**2.1 INSULATION - GENERAL: (CONT)**

- C. Where more than one type of insulation is specified, the type of insulation for each use is optional, except use only one type of insulation in any particular area.
- D. Insulation Products shall comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Perlite composite board	23 percent post consumer recovered paper
Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material
Foam-in-place	5 percent recovered material
Glass fiber reinforced	6 percent recovered material
Phenolic rigid foam	5 percent recovered material
Rock wool material	75 percent recovered material

The minimum-content standards are based on the weight (not the volume)

**2.2 EXTERIOR FRAMING OR FURRING INSULATION:**

- A. Batt or Blanket: Optional.
- B. Mineral Fiber: ASTM C665, Type II, Class C, Category I where framing is faced with gypsum board.
- C. Mineral Fiber: ASTM C665, Type III, Class A where framing is not faced with gypsum board.
- D. R-19 minimum.

**2.3 ACOUSTICAL INSULATION:**

- A. Mineral Fiber boards: ASTM C553, Type II, flexible, or Type III, semirigid (4.5 pound nominal density).
- B. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.
- C. Thickness as shown; of widths and lengths to fit tight against framing.

**2.4 RIGID INSULATION:**

- A. Continuous on the outside face of exterior walls where shown.
- B. Polystyrene: 1.5 inches, R7.5 Minimum

**2.5 FASTENERS:**

- A. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.
- B. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 50 mm (two inches) in diameter.

**SECTION 07 21 13  
THERMAL INSULATION**

**2.5 FASTENERS: (CONT)**

- C. Impaling Pins: Steel pins with head not less than 50 mm (two inches) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.

**2.6 ADHESIVE:**

- A. As recommended by the manufacturer of the insulation.

**2.7 TAPE:**

- A. Pressure sensitive adhesive on one face.
- B. Perm rating of not more than 0.50.
- C. Same manufacturer as insulation facing.

**PART 3 - EXECUTION**

**3.1 INSTALLATION - GENERAL**

- A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.
- B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
- C. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

**3.2 EXTERIOR FRAMING INSULATION:**

- A. Pack insulation around door frames and windows and in building expansion joints, door soffits and other voids. Pack behind outlets around pipes, ducts, and services encased in walls. Open voids are not permitted. Hold insulation in place with pressure sensitive tape.
- B. Lap vapor retarder flanges together over face of framing for continuous surface. Seal all penetrations through the insulation.
- C. Fasten blanket insulation between metal studs and exterior wall furring by continuous pressure sensitive tape along flanged edges.
- D. Ceiling Insulation :
  - 1. At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing. Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.
  - 2. In areas where suspended ceilings adjoin areas without suspended ceilings, install either blanket, batt, or mineral fiberboard extending from the suspended ceiling to underside of slab above. Secure in place to prevent collapse or separation of hung blanket, batt, or board insulation and maintain in vertical position. Secure blanket or batt with continuous cleats to structure above.

**SECTION 07 21 13  
THERMAL INSULATION**

**3.3 RIGID INSULATION ON SURFACE OF EXTERIOR WALLS:**

- A. Bond to solid vertical surfaces with adhesive as recommended by insulation manufacturer. Fill joints with adhesive cement.

**3.4 ACOUSTICAL INSULATION:**

- A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.
- B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.
- C. Do not compress insulation below required thickness except where embedded items prevent required thickness.
- D. Where acoustical insulation is installed above suspended ceilings install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.
- E. Where semirigid insulation is used which is not full thickness of cavity, adhere to one side of cavity maintaining continuity of insulation and covering penetrations or embedments in insulation.

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**SECTION 07 22 00  
ROOF AND DECK INSULATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Roof and deck insulation, vapor retarder, and cover board on new construction ready to receive roofing or waterproofing membrane.

**1.2 RELATED WORK**

- A. General sustainable design documentation requirements: Section 01 81 13 SUSTAINABLE DESIGN REQUIREMENTS.
- B. Sheet metal components and wind uplift requirements for roof-edge design: Section 07 60 00, FLASHING AND SHEET METAL.

**1.3 APPLICABLE PUBLICATIONS**

Update material requirements to agree with applicable requirements(types, grades, classes,) specified in the referenced Applicable Publications.

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American Society of Heating, Refrigeration and Air Conditioning (ASHRAE):
  - 90.1-07 .....Energy Standard for Buildings Except Low-Rise Residential Buildings
- C. ASTM International (ASTM):
  - D41-05 .....Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
  - D312-06 .....Asphalt Used in Roofing
  - D2178-04 .....Asphalt Glass Felt Used in Roofing and Waterproofing
  - D2822-05 .....Asphalt Roof Cement
  - E84-09 .....Standard Test Method for Surface Burning Characteristics of Building Material
  - F1667-05 .....Driven Fasteners: Nails, Spikes, and Staples
- D. FM Approvals: RoofNav Approved Roofing Assemblies and Products.
  - 470-10 .....Approved Standard for Class 1 Roof Coverings
  - 1-28-09 .....Loss Prevention Data Sheet: Design Wind Loads.
  - 1-29-09 .....Loss Prevention Data Sheet: Above-Deck Roof Components
  - 1-49-09 .....Loss Prevention Data Sheet: Perimeter Flashing
- E. National Roofing Contractors Association: Roofing and Waterproofing Manual

**1.4 PERFORMANCE REQUIREMENTS**

- A. Thermal Performance: Provide roof insulation meeting minimum overall average R-value of 33, with minimum R-value at any location of 20 .
- B. FM Approvals: Provide roof insulation complying with requirements in FM Approvals 4450 and 4470 as part of specified roofing system, listed in FM Approvals "RoofNav" as part of roofing system meeting Fire/Windstorm Classification in Division 07 roofing section.

**SECTION 07 22 00  
ROOF AND DECK INSULATION**

**1.5 QUALITY CONTROL**

- A. Requirements of Division 07 roofing section for qualifications of roofing system insulation Installer; Work of this Section shall be performed by same Installer.
- B. Requirements of Division 07 roofing section for inspection of Work of this Section and qualifications of Inspector.
- C. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.
- D. Requirements of roofing system uplift pressure design for specified roofing system.

**1.6 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
  - 1. Roofing cement, each type.
  - 2. Roof insulation, each type.
  - 3. Cover board, each type.
  - 4. Fastening requirements.
- C. Shop Drawings: Include plans, sections, details, and attachments.
  - 1. Nailers, cants, and terminations.
  - 2. Layout of insulation showing slopes, tapers, penetration, and edge conditions.
- D. Samples:
  - 1. Roof insulation, each type.
- E. Certificates:
  - 1. Indicating type, thermal conductance, and minimum and average thickness of insulation.
  - 2. Indicating materials and method of application of insulation system meet the requirements of FM Approvals for specified roofing system.
- F. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.6 DELIVERY, STORAGE AND MARKING**

- A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to built-up roofing for storage, handling and installation requirements.

**1.7 QUALITY ASSURANCE:**

- A. Roof insulation on combustible or steel decks shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E84, or shall have successfully passed FM Approvals 4450.
  - 1. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in-lieu-of copies of test reports.



**SECTION 07 22 00  
ROOF AND DECK INSULATION**

**1.7 QUALITY ASSURANCE: (CONT)**

2. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the particular type used for this project and the construction is listed as fire-classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM Approvals "RoofNav."
3. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

**PART 2 - PRODUCTS**

**2.1 ADHESIVE MATERIALS**

- A. Adhesive Materials, General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
  1. Liquid-type adhesive materials shall comply with VOC limits of authorities having jurisdiction.
  2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Plastic Foam Adhesives: 50 g/L.
    - b. Multipurpose Construction Adhesives: 70 g/L.
    - c. Fiberglass Adhesives: 80 g/L.
    - d. Contact Adhesives: 80 g/L.
    - e. Other Adhesives: 250 g/L.
    - f. Nonmembrane Roof Sealants: 300 g/L.
    - g. Sealant Primers for Nonporous Substrates: 250 g/L.
    - h. Sealant Primers for Porous Substrates: 775 g/L.
- B. Primer: ASTM D41.
- C. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- D. Roof Cement: Asbestos free, ASTM D2822, Type I or Type II, ; or, D4586, Type I or Type II.

**2.2 ROOF AND DECK INSULATION**

- A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer and listed as component of FM Approvals-approved roofing system.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
  1. R-20 is minimum continuous value throughout roof area Tapered above minimum. Comply with ASHRAE Standard 90.1-2007

**SECTION 07 22 00  
ROOF AND DECK INSULATION**

**2.3 INSULATION ACCESSORIES**

- A. Glass (Felt): ASTM D2178, Type VI, heavy duty ply sheet.
- B. Cants and Tapered Edge Strips:
  - 1. Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
  - 2. Tapered Edge Strips: 1:12 (one inch per foot), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.
    - a. Mineral Fiberboard: ASTM C726.
- C. Vapor Retarder:
  - 1. Self-Adhering Sheet Vapor Retarder: ASTM D1970, minimum of 1.0-mm- (40-mil-) thick, polyethylene film laminated to layer of rubberized asphalt adhesive, or 0.76- to 1.0-mm- (30- to 40-mil-) thick, polyethylene film laminated to layer of butyl rubber adhesive; maximum permeance rating of 6 ng/Pa x s x sq. m (0.1 perm).
- D. Cover Board:
  - 1. Oriented Strand Board, DOC PS 2, Exposure 1, 11 mm (7/16 inch) thick.

**2.4 FASTENERS**

- A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with FM Approvals 4470, designed for fastening substrate board to roof deck.
- B. Staples and Nails: ASTM F1667. Type as designated for item anchored and for substrate.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Comply with requirements of Division 07 roofing section.

**3.2 PREPARATION**

- A. Comply with requirements of Division 07 roofing section.

**3.3 VAPOR RETARDER INSTALLATION**

- A. General:
  - 1. Install continuous vapor retarder on roof decks where indicated.
  - 2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.
  - 3. At all pipes, walls, and similar penetrations through vapor retarder, seal openings with roof cement to prevent moisture entry from below.
  - 4. Seal penetrations with roof cement.
- B. Cast in Place Concrete Decks, Except Insulating Concrete:
  - 1. Prime deck as specified.

**SECTION 07 22 00  
ROOF AND DECK INSULATION**

**3.4 RIGID INSULATION INSTALLATION**

- A. Insulation Installation, General:
  - 1. Install roof insulation in accordance with roofing system manufacturer's written instructions.
  - 2. Base Sheet: Where required by roofing system, install one lapped base sheet specified in Division 07 roofing section by fastening to roofing substrate prior to installation of insulation.
  - 3. Cant Strips: Install preformed insulation cant strips at junctures of roofing system with vertical construction.
- B. Insulation Thickness:
  - 1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the average thermal resistance "R" value of not less than that specified in Performance Requirements Article.
  - 2. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the Government.
  - 3. Where tapered insulation is used, the thickness of the insulation at high points and roof edges shall be as shown on the drawings; the thickness at the low point (drains) shall be not less than 4 inches.
  - 4. Use not less than two layers of insulation when insulation is 68 mm (2.7 inch) or more in thickness unless specified otherwise. Stagger joints minimum 150 mm (6 inches).
- C. Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer.
- D. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.
- E. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.
- F. Cut to fit tight against blocking or penetrations.
- G. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section.
- H. Installation Method:
  - 1. Adhered Insulation:
    - a. Prime substrate as required.
    - b. Set each layer of insulation firmly in uniform application of full-spread insulation adhesive.
  - 2. Cover Board: Install cover boards over insulation with long joints in continuous straight lines with staggered end joints. Offset cover board joints from insulation joints minimum 150 mm (6 inches). Fasten cover boards according to "Adhered Insulation" requirements.

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**SECTION 07 40 00  
METAL SIDING PANELS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies uninsulated metal wall panels as shown.

**1.2 RELATED WORK**

- A. Sealant: Section 07 92 00, JOINT SEALANTS.
- B. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 MANUFACTURER'S QUALIFICATIONS**

Metal wall panels shall be products of a manufacturer regularly engaged in the fabrication and erection of metal panels of the type and design shown and specified.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Metal panel, 150 mm (six inch) square, showing finish, each color and texture.
- C. Shop Drawings: Wall panels, showing details of construction and installation. Thickness and kind of material, closures, flashing, fastenings and related components and accessories.
- D. Manufacturer's Literature and Data: Wall panels

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A653/ A653M-10..... Steel Sheet, Zinc-Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - A463-10 ..... Steel Sheet, Cold-Rolled, Aluminum-Coated, by the Hot-Dip Process
  - A924/ A924M-10..... Steel Sheet, Metallic Coated by the Hot-Dip Process
  - A1008/ A1008M-10..... Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy
  - B209/ 209M-07..... Aluminum and Aluminum Alloy Sheet and Plate
  - C1396-11..... Standard Specification for Gypsum Board

**PART 2 - PRODUCTS**

**2.1 COMPOSITE PANEL**

- A. Face Sheets: minimum 0.51mm (0.02 inch) thick .
- B. Aluminum Sheet: ASTM B 205.
- C. Core: Thermoplastic fabricated into thermally bonded composite assembly

**SECTION 07 40 00  
METAL SIDING PANELS**

**2.1 COMPOSITE PANEL (CONT)**

- D. Panel Thickness: 3/16 inch (4mm)
- E. Fire Rating: Tested to ASTM E 84
  - 1. Flame Spread: 10
  - 2. Smoke Developed: Maximum 0
- F. Peel Strength: 22.5 inch-pound per inch, tested ASTM D 1781
- G. Design Basis: KPS System A by Keith Panel System

**2.2 ALUMINUM PLATE AND SHEET**

ASTM B209/209M

**2.3 FASTENERS**

Fasteners for panels shall be stainless steel with carbide head, Type S, self tapping, self drilling screws.

Fasteners of size, type and holding strength as recommended by manufacturer.

**2.4 FABRICATION**

- A. Composite metal wall panels shall be of approximate overall depth and configuration shown on drawings. Connection between panels shall be by interlocking joints filled with sealing compound as specified in Section 07 92 00, JOINT SEALANTS. Furnish wall panels in one continuous length for full height or at least one story height with no horizontal joints, except at openings. Construct panels as follows:
  - 1. Accessories and flashing shall be the same material as the panels. Thickness and installation of accessories and flashing shall be as recommended by the panel manufacturer.

**2.5 FINISH**

- A. For composite wall panels, the finishes shall be as follows for aluminum face sheets:
  - 1. PPG Duranar, PVDF, Minimum 70 percent Kynar 500 or Hylar 5000 resin content, factory applied baked-on finish, conforming to AAMA 2605
  - 2. Sheen: 30 percent

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. General: Install panels in accordance with the manufacturer's approved erection instructions and diagrams, except as specified otherwise. Panels shall be in full and firm contact with supports and with each other at side and end laps. Where panels are cut in the field, or where any of the factory applied coverings or coatings are abraded or damaged in handling or installation, they shall, after the necessary repairs have been made with material of the same type and color as the weather coating, be approved before being installed. All cut ends and edges, including those at openings through the sheets shall be sealed completely. Correct defects or errors in the materials in an

**SECTION 07 40 00  
METAL SIDING PANELS**

**3.1 INSTALLATION (CONT)**

- approved manner. Replace materials which cannot be corrected in an approved manner with nondefective material. Provide molded closure strips where indicated and whenever sheets terminate with open ends after installation.
- B. Wall Panels: Apply panels with the configuration in a vertical position. Provide panels in full heights from base to eave with no horizontal joints except at the junctions of door frames, window frames, louver panels, and similar locations. Seal side and end laps with joint sealing material. Flash and seal walls at the base, at the top, around windows, door frames, framed louvers, and other similar openings. Install closure strips, flashings, and sealing material in an approved manner that will assure complete weather tightness. Flashing will not be required where approved "self-flashing" panels are used.
  - C. Flashing: All flashing and related closures and accessories in connection with the preformed metal panels shall be provided as indicated and as necessary to provide a watertight installation. Details of installation, which are not indicated, shall be in accordance with the panel manufacturer's printed instruction and details, or the approved shop drawings. Installation shall allow for expansion and contraction of flashing.
  - D. Fasteners: Fastener spacings shall be in accordance with the manufacturer's recommendations, and as necessary to withstand the design loads indicated. Install fasteners in valleys or crowns as recommended by the manufacturer of the sheet being used. Install fasteners in straight lines within a tolerance of 13 mm (1/2-inch) in the length of a bay. Drive exposed penetrating type fasteners normal to the surface, and to a uniform depth to seat gasketed washers properly, and drive so as not to damage factory applied coating. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered in valleys, or crowns, as applicable. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners shall not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels. Remove metal shavings and filings from roofs on completion to prevent rusting and discoloration of the panels.

**3.2 PROTECTION AND CLEANING**

- A. Protect panels and other components from damage during and after erection, and until project is accepted by the Government.
- B. After completion of work, all exposed finished surfaces of panels shall be cleaned of soil, discoloration and disfiguration. Touch-up abraded surfaces of panels.

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**SECTION 07 54 23**  
**THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Thermoplastic Polyolefin (TPO) sheet roofing adhered to roof deck system. Roof to be part of the ECO Roof system.
- B. Coordinate with Sections 32 91 15 and 32 93 16

**1.2 RELATED WORK**

- A. Treated wood framing, blocking, and nailers: Section 06 10 00, ROUGH CARPENTRY
- B. Roof Insulation: Section 07 22 00, ROOF AND DECK INSULATION.
- C. Sheet metal components and wind uplift requirements for roof-edge design: Section 07 60 00, FLASHING AND SHEET METAL.
- D. Roof hatches, equipment supports, dome type skylights, and gravity ventilators: Section 07 72 00, ROOF ACCESSORIES

**1.3 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):  
ANSI/SPRI ES-1-03 ..... Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
- C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):  
ASCE/SEI-7-10 ..... Minimum Design Loads for Buildings and Other Structures
- D. ASTM International (ASTM):  
D4263 ..... Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method  
D4434-06 ..... Standard Specification for Poly (Vinyl Chloride) Sheet Roofing  
D6878-08 ..... Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing  
E108-10 ..... Standard Test Methods for Fire Tests of Roof Coverings  
E408-71(R2008) ..... Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
- E. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)  
ASHRAE 90.1-2007 ..... Energy Standard for Buildings Except Low-Rise Residential Buildings, Appendix f.
- F. Cool Roof Rating Council:  
CRRC-1 ..... Product Rating Program, [www.coolroofs.org](http://www.coolroofs.org)
- G. FM Approvals: RoofNav Approved Roofing Assemblies and Products.  
4450-89 ..... Approved Standard for Class 1 Insulated Steel Deck Roofs  
4470-10 ..... Approved Standard for Class 1 Roof Coverings  
1-28-09 ..... Loss Prevention Data Sheet: Design Wind Loads.

**SECTION 07 54 23**  
**THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

**1.3 APPLICABLE PUBLICATIONS (CONT)**

- 1-29-09.....Loss Prevention Data Sheet: Above-Deck Roof Components
- 1-49-09.....Loss Prevention Data Sheet: Perimeter Flashing
- H. National Roofing Contractors Association: Roofing and Waterproofing Manual
- I. U.S. Department of Energy (DoE): Roof Products Qualified Product List,  
[www.energystar.gov](http://www.energystar.gov)

**1.4 PERFORMANCE REQUIREMENTS**

- A. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- B. Roofing System Energy Performance Requirements: Provide a roofing system identical to components that have been successfully tested by a qualified independent testing and inspecting agency to meet the following requirements:
  - 1. Energy Performance, Energy Star: Provide roofing system that is listed on DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
  - 2. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E1980 based on testing identical products by a qualified testing agency.

**1.5 QUALITY CONTROL**

- A. Installer Qualifications:
  - 1. Licensed or approved in writing by manufacturer to perform work under warranty requirements of this Section and Sections 32 91 15 and 32 93 16.
  - 2. Employ full-time supervisors knowledgeable and experienced in roofing of similar types and scopes, and able to communicate with owner and workers.
- B. Inspector Qualifications: Inspection of work by third-party technical inspector or technical representative of manufacturer experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:
  - 1. An authorized full-time technical employee of the manufacturer, not engaged in the sale of products.
- C. Product/Material Requirements:
  - 1. Obtain products from single manufacturer or from sources recommended by manufacturer for use with roofing system and incorporated in manufacturer's warranty.
- D. Roofing system design standard requirements:
  - 1. Recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to modified bituminous sheet roofing for storage, handling and application.
  - 2. Recommendations of FM Approvals 1-49 Loss Prevention Data Sheet for Perimeter Flashings.
  - 3. Recommendations of ANSI/SPRI ES-1 for roof edge design.

**SECTION 07 54 23**  
**THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

**1.5 QUALITY CONTROL (CONT)**

4. All components to be compatible to allow a single warranty for the entire system.
5. FM Approvals Listing: Provide roofing membrane, base flashing, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a roofing system and that are listed in FM Approvals "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
  - a. Fire/Windstorm Classification: Class 1A - 90
- E. Pre-Roofing Meeting:
  1. Upon completion of roof deck installation and prior to any roofing application, hold a pre-roofing meeting arranged by the Contractor and attended by the Roofing Inspector, Material Manufacturers Technical Representative, Roofing Applicator, Contractor, and Resident Engineer.
  2. Discuss specific expectations and responsibilities, construction procedures, specification requirements, application, environmental conditions, job and surface readiness, material storage, and protection.
  3. Inspect roof deck at this time to:
    - a. Verify that work of other trades which penetrates roof deck is completed.
    - b. Determine adequacy of deck anchorage, presence of foreign material, moisture and unlevel surfaces, or other conditions that would prevent application of roofing system from commencing or cause a roof failure.
    - c. Examine samples and installation instructions of manufacturer.

**1.6 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, SAMPLES.
- B. Product Data:
  1. Adhesive materials.
  2. Membrane sheet roofing and flashing membrane.
  3. Roofing cement.
  4. Roof walkway.
  5. Fastening requirements.
  6. Application instructions.
- C. Shop Drawings: Include plans, sections, details, and attachments.
  1. Base flashings and terminations.
- D. Certificates:
  1. Indicating materials and method of application of roofing system meets requirements of FM Approvals "RoofNav" for specified fire/windstorm classification.
- E. Warranty: As specified.
- F. Field reports of roofing inspector.
- G. Contract Close-out Submittals:
  1. Maintenance Manuals.
  2. Warranty signed by installer and manufacturer.

**SECTION 07 54 23**  
**THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

**1.7 DELIVERY, STORAGE AND HANDLING**

- A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to single ply membrane roofing for storage, handling and installation.

**1.8 ENVIRONMENTAL REQUIREMENTS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Environmental Controls: Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- C. Protection of interior spaces: Refer to Section 01 00 00, GENERAL REQUIREMENTS.

**1.9 WARRANTY**

Roofing work subject to the terms of the Article "Warranty of Construction," FAR clause 52.246-21, except extend the warranty period to 15 or 25 years(see Alternates) Warranty is for entire a System including roofing, insulation and ECO system materials.

**PART 2 - PRODUCTS**

**2.1 TPO MEMBRANE ROOFING**

- A. TPO Sheet: ASTM D6878, internally fabric or scrim reinforced, 1.5 mm (80 mils) thick, with no backing. BASE BID
  - 1. Color: White.
- B. TPO Sheet: ASTM D6878, internally fabric or scrim reinforced, 1.5 mm (60 mils) thick, with no backing
  - 1. Color: White. ALTERNATE BID
- C. Roofing Substrate is rigid insulation with cover board: see Section 07 22 00, ROOF AND DECK INSULATION
- D. Design Basis: Firestone - UltraPly TPO .060" or Platinum TPO .080" as part of the SkyScape Vegetative Roof System

**2.2 ACCESSORIES:**

- A. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.
- B. Bonding Adhesive: Manufacturer's standard, water based.
- C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 25 by 3 mm (1 by 1/8 inch) thick; with anchors.
- D. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 25 mm wide by 1.3 mm (1 inch wide by 0.05 inch) thick, prepunched.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with FM Approvals 4470, designed for fastening membrane to substrate.
- F. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads approximately 5 mm (3/16 inch) thick, and acceptable to membrane roofing system manufacturer.

**SECTION 07 54 23**  
**THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

**2.2 ACCESSORIES: (Cont)**

- G. Miscellaneous Accessories: Provide sealers, preformed flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories acceptable to manufacturer.

**2.3 ADHESIVE AND SEALANT MATERIALS:**

- A. General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
  2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Plastic Foam Adhesives: 50 g/L.
    - b. Gypsum Board and Panel Adhesives: 50 g/L.
    - c. Multipurpose Construction Adhesives: 70 g/L.
    - d. Fiberglass Adhesives: 80 g/L.
    - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
    - f. Other Adhesives: 250 g/L.
    - g. PVC Welding Compounds: 510 g/L.
    - h. Adhesive Primer for Plastic: 650 g/L
    - i. Single-Ply Roof Membrane Sealants: 450 g/L.
    - j. Nonmembrane Roof Sealants: 300 g/L.
    - k. Sealant Primers for Nonporous Substrates: 250 g/L.
    - l. Sealant Primers for Porous Substrates: 775 g/L.

**PART 3 - EXECUTION**

**3.1 EXAMINATION:**

- A. Examine substrates and conditions with roofing Installer and roofing inspector to verify compliance with project requirements and suitability to accept subsequent roofing work. Correct unsatisfactory conditions before proceeding with roofing work.
- B. Do not apply roofing if roof surface will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless system is protected.

**3.2 PREPARATION**

- A. Complete roof deck construction prior to commencing roofing work:
1. Install curbs, blocking, edge strips, nailers, cants, and other components where insulation, roofing, and base flashing is attached to, in place ready to receive insulation and roofing.
  2. Complete deck and insulation to provide designed drainage to working roof drains.
  3. Document installation of related materials to be concealed prior to installing roofing work.

**SECTION 07 54 23**  
**THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

**3.2 PREPARATION (CONT)**

- B. Dry out surfaces, including the flutes of metal deck that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates.
- C. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- D. Remove projections that might damage materials.

**3.3 TEMPORARY PROTECTION**

- A. Install temporary protection at the end of day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent. Comply with approved temporary protection plan.
- B. Install temporary cap flashing over the top of base flashings where permanent flashings are not in place to provide protection against moisture entering the roof system through or behind the base flashing. Securely anchor in place to prevent blow off and damage by construction activities.
- C. Provide for removal of water or drainage of water away from the work.
- D. Provide temporary protection over installed roofing by means of duckboard walkways, plywood platforms, or other materials, as approved by Resident Engineer, for roof areas that are to remain intact, and that are subject to foot traffic and damage. Provide notches in sleepers to permit free drainage.

**3.4 INSTALLATION, GENERAL**

- A. FM Approvals Installation Standard: Install roofing membrane, base flashings, wood cants, blocking, curbs, and nailers, and component materials in compliance with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system as listed in FM Approval's "RoofNav" for fire/windstorm classification indicated. Comply with recommendations in FM Approvals' Loss Prevention Data Sheet 1-49, including requirements for wood nailers and cants.
- B. NRCA Installation Standard: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations.
- C. Manufacturer Recommendations: Comply with roofing system manufacturer's written installation recommendations.
- D. Coordination with related work: Coordinate roof operations with roof insulation and sheet metal work so that insulation and flashings are installed concurrently to permit continuous roofing operations.
- E. Installation Conditions:
  - 1. Apply dry roofing materials. Apply roofing work over dry substrates and materials.
  - 2. Apply materials within temperature range and surface and ambient conditions recommended by manufacturer.
  - 3. Except for temporary protection, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, ice, fog or frost) is present in any amount in or on the materials to be covered or installed:
    - a. Do not apply materials when the temperature is below 4 deg. C (40 deg. F).
    - b. Do not apply materials to substrate having temperature of 4 deg. C (40 deg. F) or less.

**SECTION 07 54 23**  
**THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

**3.4 INSTALLATION, GENERAL (CONT)**

- F. Roof Installation to comply with Firestone SkyScape Vegetative Roof System Design and Application Guide.

**3.5 INSTALLATION OF TPO ROOFING**

- A. Do not allow the membrane to come in contact with surfaces contaminated with asphalt, coal tar, oil, grease, or other substances which are not compatible with TPO.
- B. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.
- C. Commence installation at the low point of the roof and work towards the high point. Lap the sheets so the flow of water is not against the edges of the sheet.
- D. Position the membrane so it is free of buckles and wrinkles.
- E. Roll sheet out on deck; inspect for defects as being rolled out and remove defective areas. Allow for relaxing before proceeding.
  - 1. Lap edges and ends of sheets 50 mm (two inches) or more as recommended by the manufacturer.
  - 2. Heat weld laps. Apply pressure as required. Seam strength of laps as required by ASTM D4434.
  - 3. Check seams to ensure continuous adhesion and correct defects.
  - 4. Finish edges of laps with a continuous beveled bead of sealant to sheet edges to provide smooth transition.
  - 5. Finish seams as the membrane is being installed (same day).
  - 6. Anchor perimeter to deck or wall as specified.
- F. Repair areas of welded seams where samples have been taken or marginal welds, bond voids, or skips occurs.
- G. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (four-inches) beyond cut.
- H. Membrane Perimeter Anchorage:
  - 1. Install metal fastening strip at the perimeter of each roof level, curb flashing, expansion joints and similar penetrations as indicated and in accordance with membrane manufacturer's instructions on top of roof membrane to deck or wall.
  - 2. Mechanically Fastened Metal Fastening Strip:
    - a. Set top of mechanical fastener set flush with top surface of the metal fastening strip. Space mechanical fasteners a maximum 300 mm (12 inches) on center starting 25 mm (one inch) from the end of the nailing strip.
    - b. When strips are cut round corners and eliminate sharp corners.
    - c. After mechanically fastening strip cover and seal strip with a six-inch wide roof membrane strip; heat weld to roof membrane and seal edges.
    - d. At roof edge metal, turn the membrane down over the front edge of the blocking or the nailer to below blocking. Secure the membrane to the vertical portion of the nailer; or, if required by the membrane manufacturer with fasteners spaced not over 300 mm (12 inches) on centers.

**SECTION 07 54 23**  
**THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

**3.5 INSTALLATION OF TPO ROOFING (CONT)**

- e. At parapet walls, intersecting building walls and curbs, carry membrane up and over top of wall, secure the membrane to the wall with fasteners 300 mm (12 inches) on centers or as shown on NRCA manual and manufacturers recommendations.
- I. Adhered System:
  - 1. Apply adhesive in quantities required by roof membrane manufacturer.
  - 2. Fold sheet back on itself after rolling out and coat the bottom side of the membrane and the top of the deck with adhesive. Do not coat the lap joint area.
  - 3. After adhesive has set according to adhesive manufacturers application instruction, roll the membrane into the adhesive in a manner that minimizes voids and wrinkles.
  - 4. Repeat for other half of sheet. Cut voids and wrinkles to lay flat and clean for repair patch over cut area.

**3.6 INSTALLATION OF FLASHING**

- A. Install flashings as the membrane is being installed. If the flashing can not be completely installed in one day, complete the installation until the flashing is in a watertight condition and provide temporary covers or seals.
- B. Flashing Roof Drains:
  - 1. Install roof drain flashing as recommended by the membrane manufacturer, generally as follows:
    - a. Coordinate to set the metal drain flashing in asphalt roof cement, holding cement back from the edge of the metal flange.
    - b. Do not allow the roof cement to come in contact with the TPO roof membrane.
    - c. Adhere the TPO roof membrane to the metal flashing with the membrane manufacturer's recommended adhesive.
  - 2. Turn down the metal drain flashing and TPO roof membrane into the drain body and install clamping ring and strainer.
- C. Installing TPO Base Flashing and Pipe Flashing:
  - 1. Install TPO flashing membranes to pipes, wall or curbs to a height not less than eight-inches above roof surfaces and 100 mm (four inches) on roof membrane.
    - a. Adhere flashing to pipe, wall or curb with adhesive.
    - b. Form inside and outside corners of TPO flashing membrane in accordance with NRCA manual. Form pipe flashing in accordance with NRCA manual use pipe boot.
    - c. Lap ends not less than 100 mm (four inches).
    - d. Heat weld flashing membranes together and flashing membranes to roof membranes. Finish exposed edges with sealant as specified.
    - e. Install flashing membranes in accordance with NRCA manual.
  - 2. Anchor top of flashing to walls or curbs with fasteners spaced not over 200 mm (eight inches) on centers. Use fastening strip on ducts. Use pipe clamps on pipes or other round penetrations.
  - 3. Apply sealant to top edge of flashing.
- D. Repairs to membrane and flashings:
  - 1. Remove sections of TPO sheet roofing or flashing that is creased wrinkled or fishmouthed.



**SECTION 07 54 23**  
**THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

**3.6 INSTALLATION OF FLASHING (CONT)**

2. Cover removed areas, cuts and damaged areas with a patch extending 100 mm (four inches) beyond damaged, cut, or removed area. Heat weld to roof membrane or flashing. Finish edge of lap with sealant as specified.

**3.7 FLEXIBLE WALKWAYS**

- A. Use reinforced sheet or tiles not less than 900 mm (three feet) wide.
- B. Heat weld walkway sheet to roof sheet at edges. Weld area 50 mm (two inches) wide by the entire length of the walkway sheet or tiles.
- C. Finish edges of laps with sealants as specified.
- D. Locate where shown on Drawings.

**3.8 FIELD QUALITY CONTROL:**

- A. Roofing Inspector: Owner will engage a qualified roofing inspector to perform roof tests and inspections and to prepare test reports.
  1. Examine and probe seams in the membrane and flashing in the presence of Resident Engineer and Membrane Manufacturer's Inspector.
  2. Probe edge of welded seams with a blunt tipped instrument. Use sufficient hand pressure to detect marginal welds, voids, skips, and fishmouths.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
  1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of roofing work where test results or inspections indicate that they do not comply with specified requirements.
  1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

**3.9 PROTECTING AND CLEANING**

- A. Protect membrane roofing system from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of acceptance by Owner.
- C. Clean overspray and spillage from adjacent construction. Clean membrane and restore surface to like-new condition meeting solar reflectance requirements.

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**SECTION 07 55 13**  
**VEGETATED PROTECTED ROOFING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fluid applied roofing system including:
  - 1. Substrate: Concrete.
  - 2. Leak Detection System.
  - 3. Surface conditioner.
  - 4. Reinforcing fabric.
  - 5. Flashing.
  - 6. Root barrier.
  - 7. Drainage panel.
  - 8. Water retention mat.
  - 9. Filter fabric.
  - 10. Growing Media
  - 11. Extensive planting assembly.
  - 12. Intensive planting assembly.
- B. Cant strips and other accessories.

**1.02 DEFINITIONS**

- A. Vegetated Protected Roof: Area of planting/landscaping, built up on a waterproofed substrate at any level that is separated from natural ground by a man-made structure.
  - 1. System of drainage, water retention and root barrier components utilized in construction of vegetated protected roofs over waterproofed substrate.
- B. Extensive Roof: Low to no maintenance landscaping consisting of shallow growing media depths (less than 6 inches (200mm)) with plant varieties restricted to primarily mosses, herbs and succulents capable of withstanding harsh growing conditions.
- C. Intensive Roof: Landscaping requiring regular maintenance, consisting of deeper growing media depths (greater than 6 inches (200mm)) with a wider variety of plant species possible including shrubs and small trees.
- D. Semi-Intensive Roof: Landscaping requiring more regular maintenance than an extensive condition but limited in plant selection due to shallower growing media depths, (i.e., sod grass lawn).
- E. Finish Grade: Elevation of finished surface of planting growing media including bark mulch layer.
- F. Subgrade: Surface or elevation of subsoil after layering backfill, before placing plant.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog data for membrane and bitumen materials, base flashing materials, insulation, vapor retarder, and surfacing.
- C. Product Data:
  - 1. Chemical Additives.
  - 2. Organic growing media Component.
  - 3. Fertilizers.
  - 4. Mineral growing media Component.
  - 5. Organic Amendment.
  - 6. Test Reports: Current test reports for proposed sand, showing chemical and physical characteristics.

## SECTION 07 55 13

### VEGETATED PROTECTED ROOFING

7. Certifications: Document certifying sterilized topsoil.
  8. Purchase Documentation:
    - a. Fertilizer/amendment purchase and delivery invoices.
    - b. Light weight growing media mix purchase and delivery invoices.
  9. Product Samples: Submit one (1) quart sample of planting growing media mix for review 30 days prior to delivery to site.
  10. Provide testing certification of cultivated weight limits for growing media
- D. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout.
- E. Samples: Submit two samples 12 x 12 inches in size illustrating granule surfaced sheet, colored coated sheet, insulation, pavers, and 5 lb. bag of ballast stone.
- F. Manufacturer's qualification data.
- G. Installer's qualification data.
- H. Manufacturer's Installation Instructions: Indicate special procedures.
- I. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.
- J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- K. Certification:
  1. Approved independent testing laboratory experienced in testing rubberized asphalt material, that material meets CGSB-37.50-M89 standard for rubberized asphalt membranes, including applicable ASTM procedures.
  2. Full time quality control of production facilities responsible for manufacture of rubberized asphalt and that each batch of material is tested to insure conformance with manufacturer's published physical properties.
  3. Vegetated protected roof assembly components supplied and warranted by a single-source manufacturer.
- L. Evidence that roof membrane assembly is currently Class A listed with Underwriters Laboratories.
- M. Evidence that extruded polystyrene insulation if used is free from CFC's.
- N. Plant manufacturing rubberized asphalt material must have ISO 9002 approval as evidenced by a notarized copy of official certificate.
- O. Provide product data on vegetated protected roof assembly components.
- 1.04 QUALITY ASSURANCE
- A. Requirements of Regulatory Agencies:
  1. Meet requirements of applicable laws, codes, and regulations required by authorities having jurisdiction over Work.
  2. Provide for inspections and permits required by federal, state and local authorities in furnishing, transporting, and installing materials.
- B. Roofing Contractor shall demonstrate qualifications to perform work of this Section by submitting following documentation:
  1. Certification or license by roofing manufacturer as a locally based, authorized applicator of product installer intends to use, for a minimum of five (5) years.

## SECTION 07 55 13

### VEGETATED PROTECTED ROOFING

2. List of at least three (3) projects, satisfactorily completed within past five (5) years, of similar scope and complexity to this project. Previous experience submittal shall correspond to specific roofing system proposed for use by applicator.
  - C. Rubberized asphalt membrane product: Inert clay filler and crumb rubber to enable product to be resistant to acids (fertilizers, building washes and acid rain) and maintain membrane thickness during application.
  - D. Roofing Manufacturer: Provide in-house technical staff to assist Contractor, when necessary, in application of products and final inspection of assembly.
  - E. Roofing Manufacturer Qualifications: Manufacturer shall demonstrate qualifications to supply materials of this section by certifying following:
    1. Roofing Manufacturer must show evidence that specified rubberized asphalt has been manufactured by same source for fifteen (15) years and successfully installed on a yearly basis for a minimum of fifteen (15) years on projects of similar scope and complexity.
    2. Roofing Manufacturer must not issue warranties for terms longer than they have been manufacturing their hot fluid rubberized asphalt membrane.
- 1.05 PRE-INSTALLATION MEETING
- A. Convene one week before starting work of this section.
  - B. Manufacturer to meet with necessary parties at jobsite to review and discuss project conditions as it relates to roofing assembly integrity.
- 1.06 DELIVERY, STORAGE AND HANDLING
- A. Deliver materials in original unopened containers of packaging clearly labeled with manufacturer's name, brand name, instruction for use, identifying numbers, and U.L. labels.
  - B. Materials to be stored in a neat, safe manner, not to exceed allowable structural capacity of storage area.
  - C. Store materials in a clean, dry area protected from water and direct sunlight.
  - D. Store adhesives at temperatures between 60°F and 80°F . If exposed to lower temperatures, restore materials to 60°F minimum temperature before using.
- 1.07 FIELD CONDITIONS
- A. Application of roofing shall not commence nor proceed during inclement weather. Surfaces to receive roofing shall be free of water, dew, frost, snow and ice.
  - B. Application of roofing shall not commence nor proceed when ambient temperature is below 0°F .
  - C. Preparation and application of roofing to be conducted in well ventilated areas.
  - D. Do not expose roofing or accessories to a constant temperature in excess of 180°F (i.e., hot pipes and vents or direct steam venting, etc.).
  - E. Use care with adhesives containing petroleum distillates and flammable properties.
    1. Do not breathe vapors or use near an open fire.
    2. Do not use in confined areas without adequate ventilation.
    3. Consult container or packaging labels and Material Safety Data Sheets (MSDS) for specific safety information.
  - F. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.) to come in contact with roofing.

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### VEGETATED PROTECTED ROOFING

1. Any exposure to foreign materials or chemical discharges to be presented to roofing manufacturer for evaluation to determine any impact on roof assembly performance.

#### 1.08 WARRANTY

- A. Upon completion of work, Contractor must supply owner with a single-source warranty of U.S. origin direct from manufacturer.
- B. Warranty from manufacturer:
  1. Roofing Manufacturer and Eco-Roof System Manufacturer agrees to provide a complete warranty package to the Owner as a single point of accountability to the Owner for all warranties associated with the gypsum decking, insulation, membrane, flashing, and all Eco-roof assembly components including the leak detection system, growing media, plant materials, and irrigation system.
  2. Watertightness Warranty; includes labor and material.
    - a. Duration: 25-year
  3. Thermal Warranties; includes 80% retention of original thermal value and remain on deck at 70 mph wind gust.
    - a. Duration: 20-year
  4. Total System Warranties; covers components of roof assembly, including membrane, flashing, insulation, vegetated protected roof components, ballast and pavers.
    - a. Includes removal and replacement of vegetated protected roof components, ballast, pavers and growing media (24 inches deep) when supplied by and installed per Manufacturer's requirements.
    - b. Duration of Membrane/Flashing: 20-year (watertight condition)
    - c. Duration of Insulation: 20-year (80% of original thermal value; remain on deck withstanding wind speeds not to exceed 90 mph).
    - d. Material Integrity of vegetated protected roof components: 15-year
    - e. Duration of Pavers: 10-year (will not crack, split or disintegrate due to freeze-thaw).
    - f. Procedures in Event of System Failure: During the life of the warranty, provide 24 hour response service.

## PART 2 PRODUCTS

#### 2.01 ROOFING MANUFACTURER

- A. See Section 07 54 23 TPO roof

#### 2.02 SYSTEM DESCRIPTION

- A. Furnish and install a completed Vegetated Protected Roof Assembly including concrete surface conditioner, roofing and flashings, root barrier, thermal board insulation, air layer, moisture retention mat, water retention panel, filter fabric, engineered growing medium.
- B. Roofing Assembly Requirements:
  1. External Fire Exposure Classification: ASTM E 108 Class A, UL listed.
  2. Wind Resistance: 90 MPH.

#### 2.03 MATERIALS

- A. Substrate: See Section 03 30 00 - Cast-in-Place Concrete
- B. Roof System:
  1. See Section 07 54 23 TPO roof
- C. Surface Conditioner: Surface conditioner for concrete surfaces meeting ASTM D 41.
  1. Type recommended by manufacturer.

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**VEGETATED PROTECTED ROOFING**

- D. Leak Detection System: See 07 56 00. ???
- E. Root Barrier:
1. Extensive conditions: Combination of a fiberglass reinforced rubberized asphalt sheet and polyethylene root barrier.
    - a. Type recommended by manufacturer.
    - b. American Hydrotech, Inc., Hydroflex 30 or Root Stop WSF 40
    - c. Henry Co., G100S/S - Roof Bloc 20
  2. Intensive or extensive conditions: a 160-mil (4 mm) thick polyester reinforced, modified asphalt sheet with granular surface and root inhibiting additive.
    - a. Type recommended by manufacturer.
    - b. American Hydrotech, Inc., Hydroflex RB
    - c. Henry Co., Two (2) Layers Root Bloc 20
- F. Drainage Panel
1. Panel drainage system consisting of a three-dimensional, crush-proof, drainage core and a filter fabric.
    - a. Type recommended by manufacturer.
    - b. American Hydrotech, Inc., Hydrodrain 300
    - c. Henry Co., DB 200-S
- G. Moisture Retention Mat
1. Non-woven, synthetic fiber mat capable of retaining additional moisture for potential use by vegetation.
    - a. Type recommended by manufacturer.
    - b. American Hydrotech, Inc., Moisture Retention Mat SSM 45
    - c. Henry Co., Moisture Retention Mat
- H. Water Retention Panel:
1. Three-dimensional, molded panels of recycled material with drainage channels top and bottom sides and water retention reservoirs top side.
    - a. Type recommended by manufacturer.
    - b. American Hydrotech, Inc., Floradrain
      - 1) Extensive Conditions: FD 40
      - 2) Intensive Conditions: FD 60 filled with mineral growing media
    - c. Henry Co.
      - 1) Extensive Conditions: DB 50
      - 2) Intensive Conditions: DB 100
- I. Filter Fabric
1. Non-woven, polymeric, geotextile fabric.
    - a. Type recommended by manufacturer.
    - b. American Hydrotech, Inc., Systemfilter SF
  2. Tape: Type recommended by manufacturer.
- J. Edge Retention Flashing:
1. Custom edge restraints as indicated on drawings.
  2. Material: Stainless steel, 18 gage, size as indicated on drawings.
- K. Growing Media:
1. Custom growing media mix capable of supporting vigorous growth of specified vegetation, complying with following:
    - a. Mix Design: Extensive Phillips Soil Products, Inc. Extensive C
    - b. Mix Design: Intensive Phillips Soil Products, Inc. Intensive B (Roof Planters)
    - c. American Hydrotech, Inc., LiteTop 40.
    - d. Henry Co., Phillips Soil Products, Inc. Extensive C
  2. Expanded lightweight aggregate for use as fill material for water retention panel.

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### VEGETATED PROTECTED ROOFING

- a. American Hydrotech, Inc., LiteTop Lightweight Aggregate
    - 1) 3/8 inch - 3/4 inch expanded, lightweight aggregate.
  - L. Unit Pavers
    - 1. Manufacturer:
      - a. American Hydrotech, Inc. Product: Terra Pavers-H, Type 3 Cotillion FDX2008 - H.
      - b. Henry Co.
      - c. Substitutions: See Section 01 60 00 - Product Requirements.
    - 2. Interlock pavers within 18 feet of perimeter edge.
    - 3. Paver Weight:
      - a. Perimeter edges in 18 feet from building edges: 54 psf.
      - b. Field: 30 PSF
    - 4. Physical Properties:
      - a. Compressive Strength: ASTM C 140, >8,500 psi average min.
      - b. Flexural Strength: ASTM C 293, >1,100 psi average min.
      - c. Water Absorption: ASTM C 140, Not greater than 5%.
      - d. Freeze/Thaw: ASTM C 67, <1% loss/dry weight (50 Cycles).
      - e. Centerload: Min. 1,750 lbs.
  - M. Pedestals:
    - 1. Support and Spacing of pavers
      - a. Terra-Tabs with Terr-Adjust.
        - 1) Location: Vegetated Protected Roof and private terraces.
- 2.04 RELATED MATERIALS
- A. Plants desired are to be selected by Landscape Architect in keeping with overall plan intended.
    - 1. See Section 32 93 16 - Ecoroof Plants.

2.05

### PART 3 EXECUTION

#### 3.01 INSPECTION

- A. Examine surfaces to receive roofing assembly to verify it is acceptable and proper for application of membrane per Manufacturer's Pre-Installation & Application Guidelines.
- B. Do not proceed with installation of roof membrane assembly until roof defects have been corrected.

#### 3.02 PREPARATION

- A. Surfaces must be dry, smooth, free of depressions, voids, protrusions, clean and free of unapproved curing compounds, form release agents and other surface contaminants.
  - 1. Cast in-place concrete,
    - a. Monolithic, smooth, free of voids, spalled areas, laitance, honeycombs, and sharp protrusions.
- B. Substrate cleaning
  - 1. Sweep substrate which is to receive roof membrane.
  - 2. Blown clean using an air compressor to remove any remaining loose debris.
  - 3. Apply test patch of roofing to surface and check its adhesion.

#### 3.03 INSTALLATION

- A. Install roof system in accordance with manufacturer instructions.



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**VEGETATED PROTECTED ROOFING**

- B. Install vegetated protected roof assembly in accordance with manufacturer instructions, reviewed shop drawings and specified herein.
- 3.04 ROOT BARRIER INSTALLATION
- A. Extensive Conditions
    - 1. Embed into membrane while it is still hot for good bond
    - 2. Overlap adjoining sheet edges (dry), minimum of 2-3 inches to insure complete coverage.
  - B. Intensive Conditions
    - 1. Embed into membrane while it is still hot for good bond.
    - 2. Overlap adjoining sheet edges (dry), minimum of 4 inches and seal laps with propane torch.
- 3.05 ROOF COMPONENTS INSTALLATION
- A. Root Barrier.
    - 1. Embed into roofing membrane while it is still hot to insure a good bond.
    - 2. Install layer over separation sheet, lapping adjacent sheets 5 feet.
    - 3. Turn up vertical, roofed/flushed surfaces to completely protect waterproofing and flashings.
  - B. Moisture Retention Mat:
    - 1. Install over root barrier (when no insulation is specified) or air layer/ insulation, lapping adjacent rolls, minimum of 4 inches.
    - 2. Turn up vertical, roofed/flushed surfaces, minimum of 6 inches beyond anticipated growing media level and excess trimmed down to growing media level.
  - C. Filter Fabric:
    - 1. Install over water retention panel, lapping adjacent rolls, minimum of 6 inches.
    - 2. Provide excess material to enable it to be drawn up above anticipated growing media level.
    - 3. Trim excess down to growing media level.
- 3.06 SPECIAL SOIL / PLANT INSTALLATION
- A. Supply and install extensive or intensive engineered growing media mixes to specified depths.
  - B. Supply and plant specified vegetation strictly in accordance with Landscape Architect's instructions, plans and good practice.
- 3.07 HARD SCAPE/ACCESSORY INSTALLATION
- A. Install strips/areas of stone/paver ballast for walkways and maintenance paths and at roof perimeters, building walls, penetrations, and roof hatches to act as vegetation barriers for flashings as well as safety strips (wind, fire).
  - B. Drains: Fitted with inspection/maintenance boxes and grills.
- 3.08 FIELD QUALITY CONTROL
- A. Manufacturer's Quality Control:
    - 1. Technical representative of manufacturer to periodically (minimum 3 visits) observe Work in progress.
    - 2. Representative, as a minimum, to be present to observe deck preparation, general installation procedures and final completion.
    - 3. Notify Architect and Owner's Representative at least twenty-four (24) hours prior to any roofing Work.

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**VEGETATED PROTECTED ROOFING**

4. Work not to proceed until such observations have been made in field report and conditions have been approved in writing by Architect.
  5. Upon completion of installation to ascertain that entire systems has been installed according to manufacturer's specifications and approved details.
- B. Roof Test: On completion of horizontal membrane installation, clean area in preparation for testing.
1. Water test by leak detection system to check integrity of roofing installation.
  2. Coordinate EFVP testing with installation and curing of fluid-applied membrane waterproofing.
  3. Do not proceed with remainder of system installation until leaks, if any, have been detected and repaired.
  4. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat test. Repair damage to building.
- 3.09 PROTECTION
- A. Contractor shall assure that adequate protection is provided after installation so other trades do not damage membrane.

**END OF SECTION**

**SECTION 07 60 00  
FLASHING AND SHEET METAL**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae, drainage specialties, and formed expansion joint covers are specified in this section.

**1.2 RELATED WORK**

- A. Flashing components of factory finished roofing and wall systems: Division 07 roofing and wall system sections.
- B. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
- C. Color of factory coated exterior architectural metal and anodized aluminum items: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Integral flashing components of manufactured roof specialties and accessories or equipment: Section 07 71 00, ACCESSORIES, Division 22, PLUMBING sections and Division 23 HVAC sections.
- E. Paint materials and application: Section 09 91 00, PAINTING.
- F. Flashing of Roof Drains: Section 22 14 00, FACILITY STORM DRAINAGE .

**1.3 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):  
ANSI/SPRI ES-1-03 ..... Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems
- C. American Architectural Manufacturers Association (AAMA):  
AAMA 621 ..... Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates
- D. ASTM International (ASTM):  
A653/ A653M-09..... Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process  
B32-08..... Solder Metal  
D1187-97(R2002)..... Asphalt Base Emulsions for Use as Protective Coatings for Metal  
D4586-07 ..... Asphalt Roof Cement, Asbestos Free
- E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):  
Architectural Sheet Metal Manual.
- F. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06..... Metal Finishes Manual
- G. International Code Commission (ICC): International Building Code, Current Edition

**SECTION 07 60 00  
FLASHING AND SHEET METAL**

**1.4 PERFORMANCE REQUIREMENTS**

- A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49:
  - 1. Wind Zone 1: 1.00 to 1.44 kPa (21 to 30 lbf/sq. ft.): 2.87-kPa (60-lbf/sq. ft.) perimeter uplift force, 4.31-kPa (90-lbf/sq. ft.) corner uplift force, and 1.44-kPa (30-lbf/sq. ft.) outward force.
- B. Wind Design Standard: Fabricate and install copings, roof-edge flashings tested per ANSI/SPRI ES-1 to resist design pressure indicated on Drawings.

**PART 2 - PRODUCTS**

**2.1 FLASHING AND SHEET METAL MATERIALS**

- A. Galvanized Sheet: ASTM, A653.
- B. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).
- C. Stainless Steel: ASTM

**2.2 FLASHING ACCESSORIES**

- A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
- B. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m<sup>2</sup>( 6 lbs/100 sf).
- C. Bituminous Paint: ASTM D1187, Type I.
- D. Fasteners:
  - 1. Use galvanized steel or stainless steel for galvanized steel.
  - 2. Nails:
    - a. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
    - b. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
  - 3. Rivets: Not less than 3 mm (1/8 inch) diameter.
  - 4. Expansion Shields: Fed Spec A-A-1925A.
- E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
- F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.
- G. Roof Cement: ASTM D4586.

**2.3 SHEET METAL THICKNESS**

- A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:
- B. Concealed Locations (Built into Construction):
  - 1. Galvanized steel: 0.5 mm (0.021 inch) thick.
- C. Exposed Locations:
  - 1. Thickness is specified with each item.

**SECTION 07 60 00**  
**FLASHING AND SHEET METAL**

**2.4 FABRICATION, GENERAL**

- A. Jointing:
  - 1. Joints shall conform to following requirements:
    - a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
    - b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
    - c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
  - 2. Flat and lap joints shall be made in direction of flow.
  - 3. Soldering:
    - a. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
    - b. Completely remove acid and flux after soldering is completed.
- B. Expansion and Contraction Joints:
  - 1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
  - 2. Space joints as shown or as specified.
  - 3. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
  - 4. Fabricate joint covers of same thickness material as sheet metal served.
- C. Cleats:
  - 1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
  - 2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
  - 3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
  - 4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.
- D. Edge Strips or Continuous Cleats:
  - 1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
  - 2. Use material compatible with sheet metal to be secured by the edge strip.
  - 3. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
  - 4. Fabricate Strips for fascia anchorage to extend below the supporting construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
  - 5. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using (0.031 inch) thick stainless steel.
- E. Drips:
  - 1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
  - 2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

**SECTION 07 60 00  
FLASHING AND SHEET METAL**

**2.4 FABRICATION, GENERAL (CONT)**

F. Edges:

1. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
2. All metal roof edges shall meet requirements of IBC, current edition.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.

**2.5 FINISHES**

- A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
- B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.
- C. Finish exposed metal surfaces as follows, unless specified otherwise:
  1. Stainless Steel: Finish No. 2B or 2D.
  2. Steel and Galvanized Steel:
    - a. Finish painted under Section 09 91 00, PAINTING unless specified as prefinished item.
    - b. Manufacturer's finish:
      - 1) Fluorocarbon Finish: AAMA 621, high performance organic coating.

**2.6 THROUGH-WALL FLASHINGS**

- A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
  1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
  2. Fabricate so keying nests at overlaps.
- B. For Masonry Work When Concealed Except for Drip:
  1. Stainless steel
  2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
  3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.
- C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:
  1. Use same metal and thickness as counter flashing.
  2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
  3. Form exposed portion as snap lock receiver for counter flashing upper edge.
- D. Window Sill Flashing and Lintel Flashing:
  1. Use stainless steel, or nonreinforced elastomeric sheeting.
  2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
  3. Turn up back edge as shown.
  4. Form exposed portion with drip as specified or receiver.

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**FLASHING AND SHEET METAL**

**2.7 BASE FLASHING**

- A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
  - 1. Use stainless steel, thickness specified unless specified otherwise.
  - 2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use 0.5 mm (0.018 inch) stainless steel.
  - 3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
  - 4. Use stainless steel at pipe flashings.
- B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).
- C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.
- D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.

**2.8 COUNTERFLASHING (CAP FLASHING OR HOODS)**

- A. Either stainless steel, unless specified otherwise.
- B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
  - 1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
  - 2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
  - 3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
  - 4. Manufactured assemblies may be used.
  - 5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
  - 6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.
- C. One-piece Counterflashing:
  - 1. Back edge turned up and fabricate to lock into reglet in concrete.
  - 2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).
- D. Two-Piece Counterflashing:
  - 1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
  - 2. Counterflashing upper edge designed to snap lock into receiver.
- E. Surface Mounted Counterflashing; one or two piece:
  - 1. Use at existing or new surfaces where flashing can not be inserted in vertical surface.
  - 2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.

**SECTION 07 60 00  
FLASHING AND SHEET METAL**

**2.8 COUNTERFLASHING (CAP FLASHING OR HOODS) (CONT)**

3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

**2.9 HANGING GUTTERS**

- A. Fabricate gutters of not less than the following:
  1. 0.025 inch)thick stainless steel..
- B. Fabricate hanging gutters in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.
- C. Building side of gutter shall be same height as exterior side.
- D. Gutter Bead: Stiffen outer edge of gutter by folding edge over approximately 19 mm (3/4 inch) toward roof and down approximately 19 mm (3/4 inch) unless shown otherwise.
- E. Gutter Spacers:
  1. Fabricate of same material and thickness as gutter.
  2. Fabricate 25 mm (one inch) wide strap and fasten to gutters not over 900 mm (36 inches) on center.
  3. Turn back edge up 25 mm (one inch) and lap front edge over gutter bead.
  4. Rivet and solder to gutter except rivet and seal to aluminum.
- F. Outlet Tubes:
  1. Form outlet tubes to connect gutters to conductors of same metal and thickness as gutters extend into the conductor 75 mm (3 inch). Flange upper end of outlet tube 13 mm (1/2 inch).
  2. Lock and solder longitudinal seam
  3. Solder tube to gutter
  4. Fabricate basket strainers of same material as gutters.
- G. Gutter Brackets:
  1. Fabricate of same metal as gutter. Use the following:
    - b. 3 by 40 mm (1/8 by 1 1/2 inch) stainless steel.
  2. Fabricate to gutter profile.
  3. Drill two 5 mm (3/16 inch) diameter holes in anchor leg for countersunk flat head screws.

**2.10 CONDUCTORS (DOWNSPOUTS)**

- A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long [with 19 mm (3/4 inch) wide flat locked seams].
- B. Fabricate elbows by mitering, riveting, and soldering. Lap upper section to the inside of the lower piece.
- C. Fabricate conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (one inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual Plate 34, Design C for rectangular shapes and E for round shapes.
- D. Conductor Heads:
  1. Fabricate of same material as conductor.



**SECTION 07 60 00**  
**FLASHING AND SHEET METAL**

**2.10 CONDUCTORS (DOWNSPOUTS) (CONT)**

2. Fabricate conductor heads to not less than 250 mm (10 inch) wide by 200 mm (8 inch) deep by 200 mm (8 inches) from front to back.
3. Form front and side edges channel shape not less than 13 mm (1/2 inch) wide flanges with edge hemmed.
4. Slope bottom to sleeve to conductor or downspout at not less than 60 degree angle.
5. Extend wall edge not less than 25 mm (one inch) above front edge.
6. Solder joints for water tight assembly.
7. Fabricate outlet tube or sleeve at bottom not less than 50 mm (2 inches) long to insert into conductor.

**2.11 SPLASHPANS**

- A. Fabricate splash pans from the following:
  1. 0.4 mm (0.015 inch) thick stainless steel.
- B. Fabricate in accordance with Architectural Sheet Metal Manual Plate 35 with not less than two ribs as shown in alternate section.

**2.12 REGLETS**

- A. Fabricate reglets of one of the following materials:
  1. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
- B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.
- C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.
- D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.
- E. Fabricate mitered corners, fittings, and special shapes as may be required by details.

**2.13 SCUPPERS**

- A. Fabricate scuppers with minimum of 100 mm (4 inch) wide flange.
- B. Provide flange at top on through wall scupper to extend to top of base flashing.
- C. Fabricate exterior wall side to project not less than 13 mm (1/2 inch) beyond face of wall with drip at bottom outlet edge.
- D. Fabricate exterior wall flange for through wall scupper not less than 25 mm (one inch) wide on top and sides with edges hemmed.
- E. Fabricate gravel stop bar of 25 mm x 25 mm (one by one inch) angle strip soldered to bottom of scupper.
- F. Fabricate scupper not less than 200 mm (8 inch) wide and not less than 125 mm (5 inch) high for through wall scupper.
- G. Solder joints watertight.
- H. Fabricate through the wall scuppers from the following:
  1. 0.4 mm (0.015 inch) thick stainless steel

**SECTION 07 60 00**  
**FLASHING AND SHEET METAL**

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. General:

1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
7. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
8. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
9. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.

**3.2 THROUGH-WALL FLASHING**

A. General:

1. Install continuous through-wall flashing as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
6. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
7. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
8. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.

**SECTION 07 60 00**  
**FLASHING AND SHEET METAL**

**3.2 THROUGH-WALL FLASHING (CONT)**

- B. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).
- C. Flashing at Veneer Walls:
  - 1. Install near line of finish floors over shelf angles or where shown.
  - 2. Turn up against sheathing.
  - 3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
  - 4. At concrete backing, extend flashing into reglet as specified.
  - 5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.
- D. Lintel Flashing when not part of shelf angle flashing:
  - 1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
  - 2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
  - 3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.
- E. Window Sill Flashing:
  - 1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
  - 2. Turn back edge up to terminate under window frame.
  - 3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.
- F. Flashing at Masonry, Stone, or Precast Concrete Copings:
  - 1. Install flashing with drips on both wall faces unless shown otherwise.
  - 2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

**3.3 BASE FLASHING**

- A. Install where roof membrane type base flashing is not used and where shown.
  - 1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
- B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.
- C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

**3.4 COUNTERFLASHING (CAP FLASHING)**

- A. General:
  - 1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
  - 2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
  - 3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
  - 4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.

**SECTION 07 60 00  
FLASHING AND SHEET METAL**

**3.4 COUNTERFLASHING (CAP FLASHING) (CONT)**

5. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.
- B. One Piece Counterflashing:
  1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
  2. Where flashing is surface mounted on flat surfaces.
    - a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
      - 1) Locate fasteners in masonry mortar joints.
      - 2) Use screws to sheet metal or wood.
    - b. Fill joint at top with sealant.
  3. Where flashing or hood is mounted on pipe.
    - a. Secure with draw band tight against pipe.
    - b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
    - c. Completely fill joint at top with sealant.
- C. Two-Piece Counterflashing:
  1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
  2. Surface applied type receiver:
    - a. Secure to face construction in accordance, with manufacturers instructions.
    - b. Completely fill space at the top edge of receiver with sealant.
  3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.
- D. Where vented edge occur install so lower edge of counterflashing is against base flashing.
- E. When counter flashing is a component of other flashing install as shown.

**3.5 REGLETS**

- A. Install reglets in a manner to provide a watertight installation.
- B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.
- C. Butt and align end joints or each section of reglet and securely hold in position until concrete or mortar are hardened:
  1. Coordinate reglets for masonry to locate horizontally into mortar joints.

**3.6 COPINGS**

- A. General:
  1. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.
  2. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section 07 92 00, JOINT SEALANTS.

**SECTION 07 60 00**  
**FLASHING AND SHEET METAL**

**3.6 COPINGS (CONT)**

**B. Stainless steel Copings:**

1. Join ends of sheets by a 19 mm (3/4 inch) locked and soldered seam, except at intervals of 9600 mm (32 feet), provide a 38 mm (1 1/2 inch) loose locked expansion joint filled with sealant or mastic.
2. At straight runs between 7200 mm (24 feet) and 19200 mm (64 feet) locate expansion joint at center.
3. At straight runs that exceed 9600 mm (32 feet) and form the leg of a corner locate the expansion joint not more than 4800 mm (16 feet) from the corner.

**3.7 EXPANSION JOINT COVERS, INSULATED**

- A. Install insulated expansion joint covers at locations shown on curbs not less than 200 mm (8 inch) high above roof surface.
- B. Install continuous edge strips of same metal as expansion joint flange, nailed at not less than 75 mm (3 inch) centers.
- C. Install insulated expansion joint covers in accordance with manufacturer's directions locking edges to edge strips.

**3.8 HANGING GUTTERS**

- A. Hang gutters with high points equidistant from downspouts. Slope at not less than 1:200 (1/16 inch per foot).
- B. Lap joints, except for expansion joints, at least 25 mm (one inch) in the direction of flow. Rivet and seal or solder lapped joints.
- C. Support gutters in brackets spaced not more than 600 mm (24 inch) on centers, brackets attached to facial or wood nailer by at least two screws or nails.
  1. For stainless steel gutters use stainless steel brackets.
  2. Use brass or stainless steel screws.
- D. Secure brackets to gutters in such a manner as to allow free movement of gutter due to expansion and contraction.
- E. Gutter Expansion Joint:
  1. Locate expansion joints midway between outlet tubes.
  2. Provide at least a 25 mm (one inch) expansion joint space between end baffles of gutters.
  3. Install a cover plate over the space at expansion joint.
  4. Fasten cover plates to gutter section on one side of expansion joint only.
  5. Secure loose end of cover plate to gutter section on other side of expansion joint by a loose-locked slip joint.
- F. Outlet Tubes: Set bracket strainers loosely into gutter outlet tubes.

**SECTION 07 60 00**  
**FLASHING AND SHEET METAL**

**3.9 CONDUCTORS (DOWNSPOUTS)**

- A. Where scuppers discharge into downspouts install conductor head to receive discharge with back edge up behind drip edge of scupper. Fasten and seal joint. Sleeve conductors to gutter outlet tubes and fasten joint and joints between sections.
- B. Set conductors plumb and clear of wall, and anchor to wall with two anchor straps, located near top and bottom of each section of conductor. Strap at top shall be fixed to downspout, intermediate straps and strap at bottom shall be slotted to allow not less than 13 mm (1/2 inch) movement for each 3000 mm (10 feet) of downspout.
- C. Install elbows, offsets and shoes where shown and required. Slope not less than 45 degrees.

**3.9 SPLASH PANS**

- A. Install where downspouts discharge on low slope roofs unless shown otherwise.
- B. Set in roof cement prior to pour coat installation or sealant compatible with single ply roofing membrane.

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**SECTION 07 71 00  
ROOF SPECIALTIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies roof hatches; roof safety rail system.

**1.2 RELATED WORK**

- A. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- B. General insulation: Section 07 21 13, THERMAL INSULATION. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION

**1.3 QUALITY CONTROL**

- A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be completely assembled to the greatest extent possible before delivery to the site.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- C. Manufacturer's Literature and Data: Each item specified.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Material (ASTM):
  - A653/ A653M-10.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process
  - B209/ 209M-07 .....Aluminum and Aluminum Alloy-Sheet and Plate
  - B221/ 221M-08 .....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - D1187-97(R2002).....Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- C. National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series.....Metal Finishes Manual
- D. American Architectural Manufacturers Association (AAMA):
  - 2605-11 .....High Performance Organic Coatings on Architectural Extrusions and Panels.

**SECTION 07 71 00  
ROOF SPECIALTIES**

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Aluminum Sheet: ASTM B209/B209M.

**2.2 ROOF HATCH (SCUTTLE)**

- A. Fabricate from aluminum with mill finish.
- B. Curb and Cover:
  - 1. Exterior facing: Minimum 2.3 mm (0.09 inch) thick, 11 gauge, sheet aluminum,
  - 2. Interior facing: Minimum 1 mm (0.04 inch) thick sheet aluminum.
  - 3. Minimum of 50 mm (one inch) thick mineral fiber insulation between facings of cover and over exterior face of curb.
  - 4. Form exterior curb facing with an integral three and one-half inch wide roof flange and cap flashing minimum 2.3 mm (0.09 inch) thick sheet aluminum.
  - 5. Make curb 300 mm (12 inches).
  - 6. Form cover to lap curb and cap flashing.
  - 7. Size opening as shown with single leaf.
- C. Hardware:
  - 1. Provide spring snap latch with inside and outside operating handles and padlock hasp on inside.
  - 2. Provide pintle hinges.
  - 3. Provide automatic hold open and operating arm with enclosed torsion or compression spring lifting mechanism.
  - 4. Covers shall automatically lock in the open position at not less than 70 degrees.
  - 5. Provide weatherstripping at cover closure.
  - 6. Galvanize all hardware items.
- D. Assembly:
  - 1. Completely shop assemble roof scuttle.
  - 2. Fully weld all joints exposed to the weather and built into the roofing.
  - 3. Finish weld smooth where exposed.
  - 4. Operation with one hand minimum force to open and close.
  - 5. Automatic hold open arm locks with grip release.
- E. Safety Features:
  - 1. Telescoping spring balanced safety pole.
    - a). Attach to fixed ladder
    - b.) Aluminum Mill Finish

**2.3 FINISH**

- A. In accordance with NAAMM Amp 500 Series.
- B. Aluminum, Mill Finish: AA-MIX, as fabricated.
- C. Aluminum, Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1, Architectural, 0.7 mils thick.



**SECTION 07 71 00  
ROOF SPECIALTIES**

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install roof specialties where shown.
- B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
- C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.
- D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.
- E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
  - a. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
  - b. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.
  - c. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).
- F. Equipment Supports: Anchor only to building structure as per manufacturers recommendations.

**3.2 PROTECTION OF ALUMINUM**

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.
- B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

**3.3 ADJUSTING**

- A. Adjust roof hatch hardware to operate freely and so that cover will operate without binding, close tightly at perimeter, and latch securely.

**3.4 PROTECTION**

Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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**SECTION 07 84 00  
FIRESTOPPING**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Closures of openings in walls against penetration of flame, heat, and smoke or gases in fire resistant rated construction.
- B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

**1.2 RELATED WORK**

- A. Sealants and application: Section 07 92 00, JOINT SEALANTS.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.
- C. List of FM, UL, or WH classification number of systems installed.

**1.4 DELIVERY AND STORAGE**

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

**1.5 WARRANTY**

Firestopping work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to five years.

**1.6 QUALITY ASSURANCE**

FM, UL, or WH or other approved laboratory tested products will be acceptable.

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - E84-10.....Surface Burning Characteristics of Building Materials
  - E814-11.....Fire Tests of Through-Penetration Fire Stops
- C. Factory Mutual Engineering and Research Corporation (FM):
  - Annual Issue Approval Guide Building Materials
- D. Underwriters Laboratories, Inc. (UL):
  - Annual Issue Building Materials Directory
  - Annual Issue Fire Resistance Directory
  - 1479-10 .....Fire Tests of Through-Penetration Firestops
- E. Warnock Hersey (WH):
  - Annual Issue Certification Listings

**SECTION 07 84 00  
FIRESTOPPING**

**PART 2 - PRODUCTS**

**2.1 FIRESTOP SYSTEMS**

- A. Use either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m<sup>2</sup> (16 sq. in.) in overall cross sectional area.
- D. Firestop sealants used for firestopping or smoke sealing shall have following properties:
  - 1. Contain no flammable or toxic solvents.
  - 2. Have no dangerous or flammable out gassing during drying or curing of products.
  - 3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
  - 4. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
- E. Firestopping system or devices used for penetrations by conduits, or other non-metallic materials shall have following properties:
  - 1. Classified for use with the particular type of penetrating material used.
  - 2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
  - 3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.
- F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.
- G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- H. Materials to be asbestos free.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

Submit product data and installation instructions, as required by article, submittals, after an on site examination of areas to receive firestopping.

**3.2 PREPARATION**

- A. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (six inches) on either side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

**SECTION 07 84 00  
FIRESTOPPING**

**3.3 INSTALLATION**

- A. Do not begin work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
- B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.
- C. Install smoke stopping seals in smoke partitions.

**3.4 CLEAN-UP AND ACCEPTANCE OF WORK**

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the Resident Engineer.
- C. Clean up spills of liquid type materials.

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**SECTION 07 92 00  
JOINT SEALANTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

**1.2 RELATED WORK:**

- A. Sealing of site work concrete paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- B. Masonry control and expansion joint: Section 04 20 00, UNIT MASONRY.
- C. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.
- D. Glazing: Section 08 80 00, GLAZING.
- E. Glazed aluminum curtain wall: Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS.
- F. Sound rated gypsum partitions/ sound sealants: Section 09 29 00, GYPSUM BOARD.
- G. Mechanical Work: Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION .

**1.3 QUALITY CONTROL:**

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.
- C. Manufacturer's Literature and Data:
  - 1. Caulking compound
  - 2. Primers
  - 3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

**1.5 PROJECT CONDITIONS:**

- A. Environmental Limitations:
  - 1. Do not proceed with installation of joint sealants under following conditions:
    - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
    - b. When joint substrates are wet.
- B. Joint-Width Conditions:
  - 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

**SECTION 07 92 00  
JOINT SEALANTS**

**1.5 PROJECT CONDITIONS: (CONT)**

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

**1.6 DELIVERY, HANDLING, AND STORAGE:**

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 32° C (90° F) or less than 5° C (40° F).

**1.7 DEFINITIONS:**

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

**1.8 WARRANTY:**

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to two years.
- B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

**1.9 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C509-06 .....Elastomeric Cellular Preformed Gasket and Sealing Material.
  - C612-10 .....Mineral Fiber Block and Board Thermal Insulation.
  - C717-10 .....Standard Terminology of Building Seals and Sealants.
  - C834-10 .....Latex Sealants.
  - C919-08. ....Use of Sealants in Acoustical Applications.
  - C920-10 .....Elastomeric Joint Sealants.
  - C1021-08 .....Laboratories Engaged in Testing of Building Sealants.
  - C1193-09 .....Standard Guide for Use of Joint Sealants.
  - C1330-02 (R2007) .....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
  - D1056-07 .....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
  - E84-09.....Surface Burning Characteristics of Building Materials.
- C. Sealant, Waterproofing and Restoration Institute (SWRI). The Professionals' Guide



**SECTION 07 92 00  
JOINT SEALANTS**

**PART 2 - PRODUCTS**

**2.1 SEALANTS:**

- A. S-1:
  - 1. ASTM C920, silicone, neutral cure.
  - 2. Type S.
  - 3. Class: Joint movement range of plus 100 percent to minus 50 percent.
  - 4. Grade NS.
  - 5. Shore A hardness of 15-20.
  - 6. Minimum elongation of 1200 percent.

**2.2 CAULKING COMPOUND:**

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

**2.3 COLOR:**

- A. Sealants used with exposed masonry shall match color of mortar joints.
- B. Sealants used with unpainted concrete shall match color of adjacent concrete.
- C. Color of sealants for other locations shall match adjacent material color.

**2.4 JOINT SEALANT BACKING:**

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
  - 1. Type C: Closed-cell material with a surface skin.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

**2.5 FILLER:**

- A. Mineral fiber board: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

**2.6 PRIMER:**

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

**SECTION 07 92 00  
JOINT SEALANTS**

**2.7 CLEANERS-NON POURIOUS SURFACES:**

Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

**PART 3 - EXECUTION**

**3.1 INSPECTION:**

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

**3.2 PREPARATIONS:**

- A. Prepare joints in accordance with manufacturer's instructions and SWRI.
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
  - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
  - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
  - 1. Apply primer prior to installation of back-up rod or bond breaker tape.
  - 2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

**SECTION 07 92 00  
JOINT SEALANTS**

**3.3 BACKING INSTALLATION:**

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

**3.4 SEALANT DEPTHS AND GEOMETRY:**

- A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.
- B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

**3.5 INSTALLATION:**

- A. General:
  - 1. Apply sealants and caulking only when ambient temperature is between 5° C and 38° C (40° and 100° F).
  - 3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
  - 4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
  - 5. Avoid dropping or smearing compound on adjacent surfaces.
  - 6. Fill joints solidly with compound and finish compound smooth.
  - 7. Tool joints to concave surface unless shown or specified otherwise.
  - 8. Apply compounds with nozzle size to fit joint width.
  - 9. Test sealants for compatibility with each other and substrate. Use only compatible sealant.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.
- C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
  - 1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
  - 2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
  - 3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
  - 4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
  - 5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

**SECTION 07 92 00  
JOINT SEALANTS**

**3.6 CLEANING:**

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained condition.

**3.7 LOCATIONS:**

- A. Exterior Building Joints, Horizontal and Vertical:
  - 1. Metal to Metal: Type S-1,
  - 2. Metal to Masonry or Stone: Type S-1
  - 3. Masonry to Masonry or Stone: Type S-1
  - 4. Stone to Stone: Type S-1
  - 5. Cast Stone to Cast Stone: Type S-1
  - 6. Threshold Setting Bed: Type S-1,
  - 7. Masonry Expansion and Control Joints: Type S- 1
  - 8. Wood to Masonry: Type S-1
- B. Metal Reglets and Flashings:
  - 1. Flashings to Wall: Type S-1
  - 2. Metal to Metal: Type S-1
- C. Sanitary Joints:
  - 1. Walls to Plumbing Fixtures: Type S-1
  - 2. Counter Tops to Walls: Type S-1
  - 3. Pipe Penetrations: Type S-1
- D. Interior Caulking:
  - 1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Type C-1
  - 2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1
  - 3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1
  - 6. Exposed Acoustical Joint at Sound Rated Partitions Type C-1and C-2
  - 7. Concealed Acoustic Sealant Types C-1 and C-2

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**SECTION 08 11 13  
HOLLOW METAL DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies steel doors, steel frames and related components.
- B. Terms relating to steel doors and frames as defined in ANSI A123.1 and as specified.

**1.2 RELATED WORK**

- A. Frames fabricated of structural steel: Section 05 50 00, METAL FABRICATIONS.
- B. Aluminum frames entrance work: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- D. Overhead doors including loading docks: Section 08 33 00, COILING DOORS AND GRILLES.
- E. Door Hardware: Section 08 71 00, DOOR HARDWARE.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data
- C. Shop Drawings indicating type, size, glass, louvers attachment details and installation of doors and frames.
- D. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.4 SHIPMENT**

- A. Prior to shipment label each door and frame to show location, size, door swing and other pertinent information.
- B. Fasten temporary steel spreaders across the bottom of each door frame.

**1.5 STORAGE AND HANDLING**

- A. Store doors and frames at the site under cover.
- B. Protect from rust and damage during storage and erection until completion.

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- C. Door and Hardware Institute (DHI):
  - A115 Series .....Steel Door and Frame Preparation for Hardware, Series A115.1 through A115.17 (Dates Vary)

**SECTION 08 11 13  
HOLLOW METAL DOORS AND FRAMES**

**1.6 APPLICABLE PUBLICATIONS (CONT)**

- D. Steel Door Institute (SDI):
  - 113-01 ..... Thermal Transmittance of Steel Door and Frame Assemblies
  - 128-1997 ..... Acoustical Performance for Steel Door and Frame Assemblies
  - A250.8-03 ..... Standard Steel Doors and Frames
- E. American Society for Testing and Materials (ASTM):
  - A568/568-M-07 ..... Steel, Sheet, Carbon, and High-Strength, Low-alloy, Hot-Rolled and Cold-Rolled
  - A1008-08 ..... Steel, sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability
  - E90-04 ..... Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
- F. The National Association Architectural Metal Manufacturers (NAAMM):
  - Metal Finishes Manual (1988 Edition)
- G. National Fire Protection Association (NFPA):
  - 80-09 ..... Fire Doors and Fire Windows
- H. Underwriters Laboratories, Inc. (UL):
  - Fire Resistance Directory
- I. Factory Mutual System (FM):
  - Approval Guide

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- B. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
- C. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

**2.2 FABRICATION GENERAL**

- A. GENERAL:
  - 1. Follow SDI A250.8 for fabrication of standard steel doors, except as specified otherwise. Doors to receive hardware specified in Section 08 71 00, DOOR HARDWARE. Tolerances as per SDI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.
  - 2. Close top edge of exterior doors flush and seal to prevent water intrusion.
  - 3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.
- B. Heavy Duty Doors: SDI A250.8, Level 2, Model 2 of size and design shown. Core construction types a, d, or f, for interior doors, and, types b, c, e, or f, for exterior doors.
  - 1. Standard Door in Project except where Extra Heavy Duty identified
- C. Extra Heavy Duty Doors: SDI A250.8, Level 3, Model 2 of size and design shown. Core construction Types d or f, for interior doors, and Types b, c, e, or f, for exterior doors. Use for all doors for Rooms with 'D' designation for Detension.
  - 1. Reinforced/stiffened with 14 ga. steel

**SECTION 08 11 13**  
**HOLLOW METAL DOORS AND FRAMES**

**2.2 FABRICATION GENERAL (CONT)**

2. Vision panels:
  - a. Weld 3 mm (1/8 inch) thick steel channel reinforcements around cut-outs in doors to accommodate vision lights.
  - b. Fabricate glazing stops on room side of doors, of 3 mm (1/8 inch) thick steel sheets mitered and welded at corners, and continuously welded both sides into doors.
  - c. Fabricate glazing bead for corridor side of doors of 9 mm (3/8 inch) by 19 mm (3/4 inch) steel bar, miter and weld at the corners, and fasten to doors with 6 mm (1/4 inch) countersunk screws near corners and centers of each side. Back-up screw holes with 3 mm (1/8 inch) thick reinforcements, or weld nuts to back of the frames to receive screws.
  - d. Size rabbet to provide for installation of safety glass and glazing cushions specified.

**2.3 METAL FRAMES**

- A. General:
  1. SDI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
  2. Frames for exterior doors: Fabricate from 1.7 mm (0.067 inch) thick galvanized steel conforming to ASTM A525.
  4. Frames for detention type door : Minimum 2 mm (0.093 inch) thick.
  5. Frames for doors specified to have automatic door operators
  6. Knocked-down frames are not acceptable.
- B. Reinforcement and Covers:
  1. SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
  2. Provide mortar guards securely fastened to back of hardware reinforcements except on lead-lined frames.
- C. Glazed Openings:
  - a. Integral stop on exterior, corridor, or secure side of door.
  - b. Design rabbet width and depth to receive glazing material or panel shown or specified.
- D. Frame Anchors:
  1. Floor anchors:
    - a. At bottom of jamb use 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive two 6 mm (1/4 inch) floor bolts.
    - b. Where mullions occur, provide 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two 6 mm (1/4 inch) floor bolts and frame anchor screws.
  2. Jamb anchors:
    - a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart,
    - b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
    - c. Anchors for stud partitions: Either weld to frame or use lock-in snap-in type. Provide tabs for securing anchor to the sides of the studs.
    - d. Anchors for frames set in prepared openings:
      - 2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.

**SECTION 08 11 13**  
**HOLLOW METAL DOORS AND FRAMES**

**2.3 METAL FRAMES (CONT)**

- e. Anchors for observation windows and other continuous frames set in stud partitions.
  - 1) In addition to jamb anchors, weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
  - 2) Anchors spaced 600 mm (24 inches) on centers maximum.

**2.4 LOUVERS**

- A. General:
  - 1. Sight proof type with stationary blades the full thickness of the door.
  - 2. Design lightproof louvers to exclude passage of light but permit free ventilation.
  - 3. Provide insect screen and wire guards at exterior doors, except where doors are located below completely enclosed areaways, the wire guard is not required.
- B. Fabrication:
  - 1. Steel louvers 0.8 mm (0.032 inch) thick for interior doors, and 1.3 mm (0.053 inch) inch thick for exterior doors.
  - 2. Fabricate louvers as complete units. Install in prepared cutouts in doors.
  - 3. Weld stationary blades to frames. Weld louvers into door openings.

**2.5 SHOP PAINTING**

SDI A250.8.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Plumb, align and brace frames securely until permanent anchors are set.
  - 1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
  - 2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
  - 3. Protect frame from accidental abuse.
  - 4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
- B. Floor Anchors:
  - 1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts. Use 9 mm (3/8 inch) bolts on lead lined frames.
  - 2. Power actuated drive pins may be used to secure frame anchors to concrete floors.
- C. Jamb Anchors:
  - 1. Coat frame back with a bituminous coating prior to lining of grout filling.
  - 2. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.
- D. Frames for Sound Rated Doors: Coordinate to line frames for sound rated doors with insulation.

**3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE**

Install doors and hardware as specified in Sections Section 08 14 00, WOOD DOORS Section 08 71 00, DOOR HARDWARE.

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**SECTION 08 14 00**  
**INTERIOR WOOD DOORS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies interior flush doors with prefinish, option.

**1.2 RELATED WORK**

- A. Metal door frames: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- B. Overhead doors including loading docks: Section 08 33 00, COILING DOORS AND GRILLES.
- C. Door hardware including hardware location (height): Section 08 71 00, DOOR HARDWARE.
- D. Finish: Section 09 06 00, SCHEDULE FOR FINISHES.
- E. Metal louvers: Section 08 90 00, LOUVERS AND VENTS.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Veneer sample 200 mm (8 inch) by 275 mm (11 inch) by 6 mm (1/4 inch) showing specified wood species sanded to receive a transparent finish. Factory finish veneer sample where the prefinished option is accepted.
- C. Shop Drawings:
  - 1. Show every door in project and schedule location in building.
  - 2. Indicate type, grade, finish and size; include detail of glazing louvers sound gasketing and pertinent details.
- D. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.4 WARRANTY**

- A. Doors are subject to terms of Article titled "Warranty of Construction", FAR clause 52.246-21, except that warranty shall be as follows:
  - 1. For interior doors, manufacturer's warranty for lifetime of original installation.

**1.5 DELIVERY AND STORAGE**

- A. Factory seal doors and accessories in minimum of 6 mill polyethylene bags or cardboard packages which shall remain unbroken during delivery and storage.
- B. Store in accordance with WDMA I.S.1-A, J-1 Job Site Information.
- C. Label package for door opening where used.

**SECTION 08 14 00  
INTERIOR WOOD DOORS**

**1.6 APPLICABLE PUBLICATIONS**

Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

- A. Window and Door Manufacturers Association (WDMA):
  - I.S.1-A-04 ..... Architectural Wood Flush Doors
  - I.S.4-07A..... Water-Repellent Preservative Non-Pressure Treatment for Millwork
  - T.M.6-08..... Adhesive (Glue Bond) Durability Test Method
  - T.M.7-08..... Cycle-Slam Test Method
  - T.M.8-08..... Hinge Loading Test Method
  - T.M.10-08..... Screwholding Test Method
- B. ASTM International (ASTM):
  - E90-04..... Laboratory Measurements of Airborne Sound Transmission Loss

**PART 2 - PRODUCTS**

**2.1 FLUSH DOORS**

- A. General:
  - 1. Meet requirements of WDMA I.S.1-A, Extra Heavy Duty.
  - 2. Adhesive: Type II
  - 3. Thickness: 45 mm (1-3/4 inches) unless otherwise shown or specified.
- B. Face Veneer:
  - 1. In accordance with WDMA I.S.1-A.
  - 2. One species throughout the project unless scheduled or otherwise shown.
  - 3. For transparent finishes: Premium Grade. rotary cut, Cherry
    - a. A grade face veneer standard .
    - b. Match face veneers for doors for uniform effect of color and grain at joints.
    - c. Door edges shall be same species as door face veneer
- C. Metal for stops, louvers, muntins and moldings of flush doors required to have transparent finish:
  - 1. Glazing:
    - a. On non-labeled doors use applied wood stops nailed tight on room side and attached on opposite side with flathead, countersunk wood screws, spaced approximately 125 mm (5 inches) on centers
  - 2. Metal Louvers:
    - a. Door manufacturer's standard product, fabricated of steel sections.
    - b. Steel Slats: Not less than (1/16 inch) thick.
    - c. Stiles notched out to receive slats.
    - d. Secure louvers in prepared cutouts with metal stops.

**2.2 PREFINISH, PREFIT OPTION**

- A. Flush doors may be factory machined to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame..
- B. Flush doors to receive transparent factory finished as follows:
  - 1. WDMA I.S.1-A Section F-3 specification for System TR-4, Conversion Varnish or System TR-5, Catalyzed Vinyl.
  - 2. Use stain when required to produce the finish specified in Section 09 06 00 SCHEDULE FOR FINISHES.

**SECTION 08 14 00  
INTERIOR WOOD DOORS**

**2.3 SEALING:**

Give top and bottom edge of doors two coats of catalyzed polyurethane or water resistant sealer before sealing in shipping containers.

**PART 3 - EXECUTION**

**3.1 DOOR PREPARATION**

- A. Field, shop or factory preparation: Do not violate the qualified testing and inspection agency label requirements for fire rated doors.
- B. Clearances between Doors and Frames and Floors:
  - 1. Maximum 3 mm (1/8 inch) clearance at the jambs, heads, and meeting stiles, and a 19 mm (3/4 inch) clearance at bottom, except as otherwise specified.
- C. Provide cutouts for special details required and specified.
- D. Rout doors for hardware using templates and location heights specified in Section, 08 71 00 DOOR HARDWARE.
- E. Fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (two inches) of door thickness undercut where shown.
- F. Immediately after fitting and cutting of doors for hardware, seal cut edges of doors with two coats of water resistant sealer.
- G. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.

**3.2 INSTALLATION OF DOORS APPLICATION OF HARDWARE**

Install doors and hardware as specified in this Section.

**3.3 DOOR PROTECTION**

- A. As door installation is completed, place polyethylene bag or cardboard shipping container over door and tape in place.
- B. Provide protective covering over knobs, handles and door.
- C. Maintain covering in good condition until removal is approved by Resident Engineer.

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**SECTION 08 31 13**  
**ACCESS DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Section specifies access doors or panels.

**1.2 RELATED WORK:**

- A. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Access doors, each type.
- C. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):  
A1008-10.....Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy
- C. American Welding Society (AWS):  
D1.3-08.....Structural Welding Code Sheet Steel
- D. The National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500 Series.....Metal Finishes Manual
- E. Underwriters Laboratories, Inc. (UL):  
Fire Resistance Directory

**PART 2 - PRODUCTS**

**2.1 FABRICATION, GENERAL**

- A. Fabricate components to be straight, square, flat and in same plane where required.
1. Slightly round exposed edges and without burrs, snags and sharp edges.
  2. Exposed welds continuous and ground smooth.
  3. Weld in accordance with AWS D1.3.
- B. Number of locks and non-continuous hinges as required to maintain alignment of panel with frame.

**SECTION 08 31 13**  
**ACCESS DOORS AND FRAMES**

**2.1 FABRICATION, GENERAL (CONT)**

- C. Provide anchors or make provisions in frame for anchoring to adjacent construction. Provide size, number and location of anchors on four sides to secure access door in opening.

**2.2 ACCESS DOORS, FLUSH PANEL: CEILING ACCESS PANEL-CAP / WALL ACCESS PANEL -WAP**

- A. Door Panel:
  - 1. Form of 1.9 mm (0.0747 inch) thick steel sheet.
  - 2. Reinforce to maintain flat surface.
- B. Frame:
  - 1. Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed.
  - 2. Provide surface mounted units having frame flange at perimeter where installed in concrete, masonry, or gypsum board construction.
  - 3. Weld exposed joints in flange and grind smooth.
- C. Hinge:
  - 1. Concealed spring hinge to allow panel to open 175 degrees.
  - 2. Provide removable hinge pin to allow removal of panel from frame.
- D. Lock:
  - 1. Flush, screwdriver operated cam lock.
  - 2. Provide tamper proof screws (spanner head locks) for access panels in Psychiatric Areas.

**2.2 ACCESS CABINET WITH FLUSH PANEL DOOR,: WALL ACCESS CABINET -WAC**

- A. Cabinet:
  - 1. Size: As shown on Drawings x 12" deep.
- B. Door Panel, Frame, Cabinet, Hinge and Lock to match standard access panels
- C. Construction: Welded and watertight

**2.5 FINISH:**

- A. Provide in accordance with NAAMM AMP 500 series on exposed surfaces.
- B. Steel Surfaces: Baked-on prime coat over a protective phosphate coating.

**2.6 SIZE:**

Shown on Drawings

**PART 3 - EXECUTION**

**3.1 LOCATION:**

- A. Provide access panels or doors wherever any valves, traps, dampers, cleanouts, and other control items of mechanical, electrical and conveyor work are concealed in wall or partition, or are above ceiling of gypsum board or plaster.
- B. Use flush panels in partitions and gypsum board ceilings, except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.

**SECTION 08 31 13**  
**ACCESS DOORS AND FRAMES**

**3.2 INSTALLATION, GENERAL:**

- A. Install access doors in openings to have sides vertical in wall installations, and parallel to ceiling suspension grid or side walls when installed in ceiling.
- B. Set frames so that edge of frames without flanges will finish flush with surrounding finish surfaces.
- C. Set frames with flanges to overlap opening and so that face will be uniformly spaced from the finish surface.

**3.3 ANCHORAGE:**

- A. Secure frames to adjacent construction using anchors attached to frames or by use of bolts or screws through the frame members.
- B. Type, size and number of anchoring device suitable for the material surrounding the opening, maintain alignment, and resist displacement during normal use of access door.

**3.4 ADJUSTMENT:**

- A. Adjust hardware so that door panel will open freely.
- B. Adjust door when closed so door panel is centered in the frame.

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**SECTION 08 33 00  
COILING DOORS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies coiling doors of sizes shown, complete as specified.

**1.2 RELATED WORK**

- A. Lock cylinders for cylindrical locks: Section 08 71 00, DOOR HARDWARE.
- B. Electric devices and wiring: DIVISION 26, ELECTRICAL.

**1.3 MANUFACTURER'S AND INSTALLER'S QUALIFICATIONS**

- A. Coiling doors shall be products of manufacturers regularly engaged in manufacturing items of type specified.
- B. Install items under direct supervision of manufacturer's representative or trained personnel.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each type of door showing details of construction, accessories and hardware, electrical and mechanical items supporting brackets for motors, location, and ratings of motors, and safety devices.
  - 2. Wiring diagrams for motors and controls, including wiring diagram for door showing electrical interlock of motor with manually operated dead lock, electrical rough-in.
- C. Manufacturer's Literature and Data:
  - 1. Manufacturer's installation procedures and instructions.
  - 2. Maintenance instructions, parts lists.
- D. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A36/ A36M-08.....Structural Steel
  - A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
  - A653/ A653M-10.....Steel Sheet, Zinc-Coated (Galvanized) Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

**SECTION 08 33 00  
COILING DOORS**

**1.5 APPLICABLE PUBLICATIONS (CONT)**

- C. National Electrical Manufacturers Association (NEMA):
  - ICS 1-00(R2008).....Industrial Control and Systems General Requirements
  - ICS 2-00(R2005).....Industrial Control, and Systems, Controllers, Contactors, and Overload Relays
  - ICS 6-93 (R2006).....Industrial Control and Systems Enclosures
  - MG 1-10 .....Motors and Generators
  - ST 20-92 (R1997) .....Dry-Type Transformers for General Applications
- D. National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series.....Metal Finishes Manual
- E. Underwriters Laboratories, Inc. (UL):
  - 2010 .....Fire Resistance Directory

**PART 2 - PRODUCTS**

**2.1 MATERIAL**

- A. Steel: A653 for forming operation. ASTM A36 for structural sections.
- B. Stainless Steel: ASTM A167, Type 302 or 304.

**2.2 DESIGN REQUIREMENTS**

- A. Coiling doors shall be spring counter balanced, overhead coiling type, inside face mounted with guides at jambs set back a sufficient distance to provide a clear opening when door is in open position.
- B. Doors, hardware, and anchors shall be designed to withstand a horizontal pressure of 120 psf without damage.
- C. All motor operators shall have manual emergency mechanical operators.

**2.3 FABRICATION**

- A. Curtains:
  - 1. Form of interlocking slats of galvanized steel of shapes standard with the manufacturer, except that slats for exterior doors shall be flat type.
  - 2. Thickness of slats shall be as required to resist loads specified except not less than the following:
    - a. For doors less than 4500 mm (15 feet) wide: 0.75 mm (0.0299 inch).
    - b. For doors from 4530 mm (15 feet 1 inch) to 6300 mm (21 feet wide): 0.90 mm (0.0359 inch).
    - c. For doors wider than 6330 mm (21 feet 1 inch): 1.20 mm (0.0478 inch).
- B. Endlocks and Windlocks:
  - 1. Manufacturer's stock design of galvanized malleable iron or galvanized steel for doors
  - 2. The ends of each slat for exterior doors and each alternate slat for grilles and interior doors shall have endlocks.
  - 3. Doors shall have windlocks at ends of at least every sixth slat. Windlocks shall prevent curtain from leaving guide because of deflection from wind pressure or other forces.

**SECTION 08 33 00  
COILING DOORS**

**2.3 FABRICATION (CONT)**

**C. Bottom Bar:**

1. Two angles of equal weight, one on each side, standard extruded aluminum members not less than 3 mm (0.125 inch) thick.
2. Bottom bar designed to receive weather-stripping and safety device, and be securely fastened to bottom of curtain or grille.

**D. Barrel and Spring Counterbalance:**

1. Curtain shall coil on a barrel supported at end of opening on brackets and be balanced by helical springs.
2. Barrel fabricated of steel pipe or commercial welded steel tubing of proper diameter and thickness for the size of curtain, to limit deflection with curtain rolled up, not to exceed 1 in 400 (0.03 inch per foot) of span.
3. Close ends of barrel with cast iron plugs, machined to fit the opening.
4. Within the barrel, install an oil-tempered, helical, counter balancing steel spring, capable of producing sufficient torque to assure easy operation of the door curtain from any position.
5. At least 80 percent of the door weight shall be counter balanced at any position.
6. Spring-tension shall be adjustable from outside of bracket without removing the hood or motor operator .

**E. Brackets:**

1. Steel plate designed to form end closure and support for hood and the end of the barrel assembly.
2. End of barrel or shaft shall screw into bracket hubs fabricated of cast iron or steel.
3. Equip bracket hubs or barrel plugs with prelubricated ball bearings, shielded or sealed.

**F. Hoods:**

1. Steel galvanized, 0.6 mm (0.0239 inch) thick
2. Form hood to fit contour of end brackets.
3. Reinforce at top and bottom edges with rolled beads, rods or angles. Hoods more than 3600 mm (12 feet) in length shall have intermediate supporting brackets.
4. Fasten to brackets with screws or bolts and provide for attachment to wall with bolts.

**G. Guides:**

1. Manufacturer's standard formed sections or angles of steel
  - a. Steel sections not less than 5 mm (3/16 inch) thick.
2. Form a channel pocket of sufficient depth to retain the curtain in place under the horizontal pressure specified, and prevent ends of curtain from slipping out of guide slots.
3. Top sections flared for smooth entry of curtain to vertical sections that will facilitate entry of curtain.
4. Provide stops to limit curtain travel above top of guides.
5. Provide guide of aluminum with replaceable wear strips to prevent metal to metal contact.
6. Mounting brackets shall provide closure between guides and jambs.

**H. Weather-stripping:**

1. Motor Operated Doors: Bottom bar safety device shall be a combination compressible seal and safety device as specified in paragraph, ELECTRIC MOTOR OPERATORS.

**I. Locking:**

1. Cylinder locks shall receive standard screw in cylinders furnished under Section, 08 71 00 DOOR HARDWARE.

**SECTION 08 33 00  
COILING DOORS**

**2.3 FABRICATION (CONT)**

3. For motor operated doors provide manufacturer's standard cylinder dead lock type locking device on the inside, key operated from both sides, interlocked with motor to prevent motor from operating when locks are activated.

**2.4 ELECTRIC MOTOR OPERATORS**

- A. Provide operators complete with electric motor, machine cut reduction gears, steel chain and sprockets, magnetic brake, overload protection, brackets, push button controls, limit switches, magnetic reversing contactor, and other accessories necessary for proper operation including emergency manual operator.
- B. Design:
  1. Design the operator so that the motor may be removed without disturbing the limit-switch timing and without affecting the emergency manual operators.
  2. Make provision for emergency manual operation of door
  3. Arrange the emergency manual operating mechanism so that it may be immediately put into and out of operation from the floor with an electrical or mechanical device, which will disconnect the motor from the operating mechanism when the emergency manual operating mechanism is engaged, and its use shall not affect the timing of the limit switches, in case of electrical failure.
4. Provide interlock with motor to prevent motor from operating when manual locks are activated.
- C. Motors:
  1. Motors shall conform to NEMA MG1, suitable for operation on current of the characteristics indicated, and shall operate at not more than 3600 rpm. Single-phase motors shall not have commutation or more than one starting contact. Motor enclosures shall be the drip proof type of NEMA TENV type.
  2. Motors shall be high starting torque, reversible type, of sufficient horsepower and torque output to move the door in either direction from any position, and produce a door travel speed of not less than 0.66 foot or more than one foot per second, without exceeding the rated capacity.
- D. Controls:
  1. The control equipment shall conform to NEMA ICS 1 and 2.
  2. Control enclosures shall be NEMA ICS 6, Type 12 or Type 4, except that contractor enclosures may be Type 1.
  3. Each door motor shall have an enclosed, across-the-line type, magnetic reversing contactor, thermal overload protection, solenoid operated brake, limit switches, and remote control switches at locations shown.
  4. Use key activated switches on exterior requiring constant pressure to operate.
  5. Provide limit switches to automatically stop the doors at their fully open and closed positions. Positions of the limit switches shall be readily adjustable.

**SECTION 08 33 00  
COILING DOORS**

**2.4 ELECTRIC MOTOR OPERATORS (CONT)**

6. Safety device:
  - a. The bottom bar of power-operated doors shall have a fail safe safety device that will immediately stop and reverse the door in its closing travel upon contact with an obstruction in the door opening, or upon failure of the device, or any component of the device, or any component of the control system, and cause the door to return to its full open position. The door closing circuit shall be electrically locked out, and the door shall be operable manually until the failure or damage has been corrected.
  - b. Safety device shall not be used as a limit switch.
  - c. Safety device connecting cable to motor shall be flexible "Type SO" cable and spring loaded automatic take up reel or equivalent device, as required for proper operation of the doors.
7. Transformer:
  - a. Provide a control transformer in power circuits as necessary to reduce the voltage on the control circuits to 120 volts or less.
  - b. The transformer shall conform to NEMA ST20.
8. Electrical components shall conform to NFPA 70.

**2.5 MANUAL OPERATORS**

- A. Push-up Operation:
1. Provide one lifting handle on each side of door and counterbalance in a manner to provide easy operation while raising or lowering the curtain by hand.
  2. The maximum exertion or pull required for lift handle operation shall not exceed 1197 Pa (25 psf).
  3. Provide pull-down straps or pole hooks on bottom rail of doors over 2100 mm (7 feet) high.

**2.6 FINISHES**

- A. Steel:
1. Clean surfaces of steel free from scale, rust, oil and grease, and then apply a light colored shop prime paint after fabrication.
- B. Stainless Steel:
1. Mill finish on concealed surfaces,
  2. No. 4 finish on all exposed surfaces.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install doors in accordance with approved shop drawings and manufacturer's instructions.
- B. Locate anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories accurately.
- C. Securely attach guides to adjoining construction with not less than 9 mm (3/8 inch) diameter bolts, near each end and spaced not over 600 mm (24 inches) apart.
- D. Locate Hood above suspended ceiling.

**SECTION 08 33 00  
COILING DOORS**

**3.1 INSTALLATION (CONT)**

- D. Locate control switches where shown.
- E. Install all electric devices and wiring as specified in DIVISION 26 ELECTRICAL and DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

**3.2 REPAIR**

- A. Repair prime painted zinc-coated surfaces and bare zinc-coated surfaces that are damaged by the application of galvanizing repair compound. Spot prime all damaged shop prime painted surfaces including repaired prime painted zinc-coated surfaces.
- B. Coiling Doors shall be lubricated, properly adjusted, and demonstrated to operate freely.

**3.3 INSPECTION**

Upon completion, doors shall be weathertight and doors shall be free from warp, twist, or distortion.

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**SECTION 08 35 13.23**  
**HORIZONTAL SLIDING FIRE DOORS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies horizontal sliding, accordion folding, fire rated doors.

**1.2 RELATED WORK**

- A. All support structures, surrounding insulation, jambs, storage pockets, pocket doors, access doors, blocking and trim shall be furnished and installed by other sections.
- B. All electrical wire, wiring, conduit and electrical boxes shall be furnished and installed by electrical section, including connections to smoke detectors and building fire alarm panels, and necessary pipe/wiring for badge/card access control from card reader/key switch assembly to door controller.

**1.3 MANUFACTURER'S QUALIFICATIONS**

Accordion folding doors shall be the product of a manufacturer regularly engaged in the manufacture of accordion folding doors specified.

- A. Installation shall be performed by factory trained and certified installers with a minimum of three years experience installing accordion-type fire doors.
- B. Fire doors shall be listed by Underwriters Laboratories for ratings as indicated, when tested in accordance with the requirements of UL 10B.
- C. Automatic closing system shall be listed by Underwriters Laboratories in accordance with the requirements of UL864 and be listed for use with door assembly in compliance with NFPA 80, Chapter 9. Motor operator shall be rated for continuous use with unlimited cycle duty.
- D. Fire doors used for smoke and draft control shall bear the "S" mark on the fire door label and shall have an air leakage of less than 3 ft<sup>3</sup>/ft<sup>2</sup> at 0.1 inch of water column pressure when tested in accordance with UL 1784 with an artificial bottom seal.

**1.02 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver to the job site in manufacturer's original, unopened package, labeled to show name, brand and type.
- B. Store products in a protected dry location. Replace damaged materials on-site at no cost to owner.

**1.03 COORDINATION REQUIREMENTS**

- A. Coordinate with the following:
  - 1. Fire Alarm system.
  - 2. Electrical.
  - 3. Card Reader/badge reader system
  - 4. Panel pocket doors and wood veneer paneling (if applicable).
  - 5. Floor and ceiling finish.

**SECTION 08 35 13.23**  
**HORIZONTAL SLIDING FIRE DOORS**

**1.03 CORDINATION REQUIREMENTS (CONT)**

- B. Assure accurate installation of header, jamb, and trim. Provide field dimensions for fabrication. Supervise unloading and handling of materials.
- C. Permanent power shall be in place and ready for final connection when fire doors are erected. Assure access to and proper clearance for motor operators.
- D. After testing the fire alarm system, automatic-closing fire doors shall be re-set to the original position.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Indicate construction and installation details and dimensions, including layout, electrical requirements, required stacking depth, height of header above finished floor; and requirements for anchorage and support of each door.
- C. Manufacturer's Literature and Data: Operating procedures, troubleshooting and repair methods, wiring diagrams, parts lists, and identification of authorized maintenance firms located in vicinity of project.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing And Materials (ASTM):
  - A1008/ A1008M-10.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low Alloy with Improved Formability
  - E84-10.....Surface Burning Characteristics of Building Materials

**PART 2 - PRODUCTS**

**2.1 ACCORDION FIRE DOORS - GENERAL**

- A. Provide self-closing fire doors of configurations indicated on the drawings.
  - 1. Fire rating as indicated.
- B. Fire Rating: Fire doors shall be listed by Underwriters Laboratory as special purpose fire doors having fire-resistive rating in accordance with the requirements of UL 10B and ASTM E-2074.
- C. Configuration: Single; straight; recessed in pocket.
  - 1. Striker Mounting: Recessed.



**SECTION 08 35 13.23**  
**HORIZONTAL SLIDING FIRE DOORS**

**2.2 COMPONENTS**

- A. Door Construction: Two parallel, accordion-type walls of panels independently suspended, 6 to 8 inches apart, with no pantographs or interconnections except at the lead-post.
  - 1. Panels: 24 gauge steel, V-grooved; connected by full height 24 gauge steel hinges.
  - 2. Perimeter Seals: shall consist of continuous extruded vinyl sweeps attached to the top and bottom of the fire door to form a smoke and draft seal.
  - 3. Hanging Weight: 5.5 pounds per sq ft, maximum.
  - 4. Finish: All steel parts factory-applied enamel.
  - 5. Color: Manufacturer's standard platinum.
- B. Suspension System: Two tracks, on 8 inch centers, attached to overhead structural support.
  - 1. Tracks: 14 gage cold rolled steel.
  - 2. Panel Hangers: Each panel individually suspended from a steel hanger pin and a 1/4 inch ball bearing roller.
  - 3. Lead Post Hangers: 8 wheel ball bearing trolley.
- C. Automatic Closing System shall be listed to UL864, 9<sup>th</sup> edition, including capability to send and receive signals from the Fire Control Panel, and shall consist of the following:
  - 1. Microprocessor Based Electronic Control box with the ability to:
    - a. Monitor dual power sources continually for peak performance including
      - 1) Detect a missing battery, bad battery, or low battery condition
      - 2) Detect if the charging circuit is bad
      - 3) Detect fuse failures
      - 4) Detect high or low AC conditions
    - b. Monitor the health of the drive train.
    - c. Monitor inputs including:
      - 1) Sticky door block, exit hardware, patron hardware and key switches.
      - 2) Key switch mis-wires where key open and key close are on simultaneously.
    - d. Run a "watch dog" monitoring circuit which will force a software restart in the event of software hangs, including tracking number of resets for diagnostic purposes.
    - e. Record the number of door closes, openings, lost communication with external microprocessors, and manual resets.
    - f. Monitor ambient temperature and lockout the operating devices when the environment at the door becomes untenable.
    - g. Enter a security mode to help control access through the opening.
    - h. Withstand voltages up to 120 AC on the fire alarm input circuit without damage including the ability to indicate that the alarm circuit has not been wired as a dry contact, "no voltage" circuit when errant voltages are applied to the circuit.
    - i. Communicate with other microprocessors in the assembly via an internal buss system.
    - j. Indicate faults or supervised information both locally and at a remote location.

**SECTION 08 35 13.23**  
**HORIZONTAL SLIDING FIRE DOORS**

**2.2 COMPONENTS (CONT)**

2. Motor Operator Assembly including a DC gear motor, drive sprocket, clutch, and position sensors. The motor shall drive the fire door by means of a chain attached to a stabilizer bar trolley. The motor shall be rated for continuous use with unlimited cycle duty.
  3. A door control momentary rocker switch shall be mounted on one side of the door and shall function as follows:
    - a. Pressing the upper portion shall close the door and/or clear fault conditions.
    - b. Pressing the lower portion of the switch shall open the door and/or temporarily mute the local horn.
  4. Leading Edge Obstruction Detector shall be pressure sensitive such that contact with an obstruction shall cause the door to stop, pause for 3 seconds, then re-close when in alarm mode. The obstruction detection system shall be fully functional at all times.
  5. Exit Hardware shall be located on both sides of the fire door.
  6. Doors installed at the point of access to an elevator ("E" label) shall include the following extras: track seals, anti-sway brackets every five feet or less across the opening, and foil tape between the panels and the smoke liner.
- D. Power Supply: 12-volt maintenance-free DC battery, automatically maintained at capacity by continuous charger, 120 V AC.
- E. Unitized track shall be furnished and installed. No header required. NOTE: Installation is contingent on the structural support being less than five (5) feet above the plywood header assembly. Materials included are unitized track, threaded rods, and mechanical attachment hardware only. Drilling/placement of anchorage points into pre- or post-tensioned decks is by others. Welding/punching/drilling of steel members is by others. All drywall work is by others.
- F. Door shall include a Vision Panel, consisting of a frame and clear glass assembly with listings from Underwriters Laboratory up to 1 ½ hours
- G. A card reader module shall be provided, located either at the pocket wall, or adjacent to the strike jamb, so that the door may be operated via the keyswitch rather than a rocker switch on the door itself.
- H. LEVEL 1 Access Control: The exit hardware shall not respond when pressed, until activated/over-ridden by a signal from smoke detector or fire alarm.
- I. Design Basis: Won-Door Fireguard model FG60S

**2.3 RELATED CONSTRUCTION**

- A. Track Support Construction: Provide supports attached to structure and mounting surface for tracks; comply with door manufacturer's instructions and recommendations. Headers, if furnished & installed by the general contractor or other sections, shall be parallel with the finished floor within +/- 1/8" tolerance over the entire length of the opening.

**SECTION 08 35 13.23**  
**HORIZONTAL SLIDING FIRE DOORS**

**2.3 RELATED CONSTRUCTION (Cont)**

- B. Pocket Construction: Provide pocket for concealment of accordion door when open; comply with door manufacturer's instructions and recommendations to ensure pocket and soffit are built to the dimensions specified, plumb and level.
- C. Pocket Door: Maintain full pocket clear width when pocket door is open. Provide mechanical latching system so that pocket cover door is not capable of being opened unless fire door is activated and causes latch to release.
- D. Striker Recess: Mount extruded aluminum striker in wall recess deep enough to prevent striker from protruding beyond face of wall; construct recess to maintain fire rating of wall.

**PART 3 - EXECUTION**

**3.1 SITE CONDITIONS**

Verify field dimensions prior to fabrication.

- A. Verify that adjacent construction is suitable for installation of door.
- B. Verify that electrical utilities have been installed and are accessible.
- C. Verify access to, and proper clearance for, motor operators in wall cavity.
- D. Verify that door opening is plumb and header is level and of correct dimensions.
- E. Notify Architect of any unacceptable conditions or varying dimensions.
- F. Commencement of work indicates acceptance of substrate and opening.

**3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions, shop drawings, and NFPA 80.
- B. Install fire doors plumb and level.
- C. Install wiring in accordance with applicable codes and NFPA 70.

**3.3 ADJUSTING**

- A. Adjust door installation to provide uniform clearances and smooth, quiet, non-binding operation.
- B. Test door closing functions under all anticipated conditions.
- C. Verify that all operations are functional and meet the requirements of the authorities having jurisdiction.

**3.4 CLEANING**

- A. Clean surfaces using manufacturer's recommended means and methods.

**3.5 PROTECTION**

- A. Protect installed work from damage.
- B. Repair or replace defective work prior to Substantial Completion.

**SECTION 08 35 13.23**  
**HORIZONTAL SLIDING FIRE DOORS**

**3.6 STORAGE OF WASTE AND RECYLING**

- A. Store and recycle waste in accordance with Section 01 7419 Construction Waste Management and Disposal.

**3.7 CLOSEOUT ACTIVITIES**

- A. A comprehensive owner training seminar will be conducted by a factory-trained service technician. The owner training shall include horizontal sliding, accordion-type fire door operation, care, maintenance, testing and trouble-shooting.

**3.8 MAINTENANCE**

- A. A Manufacturers Service Agreement shall cover years 2 through 5 and include regularly scheduled testing and inspection of all door functions. The Service Agreement will include (select one: annual, semi-annual, quarterly or monthly) visits to inspect, test and perform all required maintenance. All service and maintenance functions are to be performed by factory-trained service technicians.

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**SECTION 08 41 13**  
**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies aluminum entrance work including storefront construction, hung doors, interior window walls and other components to make a complete assemblies.

**1.2 RELATED WORK:**

- A. Glass and Glazing: Section 08 80 00, GLAZING.
- B. Hardware: Section 08 71 00, DOOR HARDWARE.
- C. Automatic Door Operators: Section 08 71 13, AUTOMATIC DOOR OPERATORS.
- D. Texture and color of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: (1/2 full scale) showing construction, anchorage, reinforcement, and installation details.
- C. Manufacturer's Literature and Data:
  - 1. Doors, each type.
  - 2. Entrance and Storefront construction.
- D. Samples:
  - 1. Two samples of organic finish of each color specified.
  - 2. Two samples of standard section.
- E. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.4 QUALITY ASSURANCE:**

- A. Approval by Contracting Officer is required of products of proposed manufacturer, or supplier, and will be based upon submission by Contractor certification.
- B. Certify manufacturer regularly and presently manufactures aluminum entrances and storefronts as one of their principal products.

**1.5 DELIVERY, STORAGE AND HANDLING:**

- A. Deliver aluminum entrance and storefront material to the site in packages or containers; labeled for identification with the manufacturer's name, brand and contents.
- B. Store aluminum entrance and storefront material in weather-tight and dry storage facility.
- C. Protect from damage from handling, weather and construction operations before, during and after installation.

**SECTION 08 41 13**  
**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

**1.6 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate

**1.6 APPLICABLE PUBLICATIONS: (CONT)**

- B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - E283-04.....Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  - E331-00(R2009) .....Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
  - F468-10.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
  - F593-02(R2008).....Stainless Steel Bolts, Hex Cap Screws, and Studs
- C. National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series.....Metal Finishes Manual
- D. American Architectural Manufacturer's Association (AAMA):
  - 2604-10 .....High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels
- E. American Welding Society (AWS):
  - D1.2-08 .....Structural Welding Code Aluminum

**1.7 PERFORMANCE REQUIREMENTS:**

- A. Shapes and thickness of framing members shall be sufficient to withstand a design wind load of not less than 90 pounds per square foot) of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65 (applied to overall load failure of the unit). Provide glazing beads, moldings, and trim of not less than 1.25 mm (0.050 inch) nominal thickness.
- B. Air Infiltration: When tested in accordance with ASTM E 283, air infiltration shall not exceed 2.63 x 10<sup>-5</sup> cm per square meter (0.06 cubic feet per minute per square foot) of fixed area at a test pressure of 0.30 kPa (6.24 pounds per square foot) 80 kilometers (50 mile) per hour wind.
- C. Water Penetration: When tested in accordance with ASTM E 331, there shall be no water penetration at a pressure of 0.38 kPa (8 pounds per square foot) of fixed area.

**SECTION 08 41 13**  
**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. Aluminum, ASTM B209 and B221:
  - 1. Alloy 6063 temper T5 for doors, door frames, storefronts and windows.
  - 2. Alloy 6061 temper T6 for guide tracks for sliding doors and other extruded structural members.
  - 3. For color anodized finish, use aluminum alloy as required to produce specified color.
- B. Thermal Break: Manufacturer standard low conductive material retarding heat flow in the framework, where insulating glass is scheduled.
- C. Fasteners:
  - 1. Aluminum: ASTM F468, Alloy 2024.
  - 2. Stainless Steel: ASTM F593, Alloy Groups 1, 2 and 3.

**2.2 FABRICATION:**

- A. Fabricate doors, of extruded aluminum sections not less than 3 mm (0.125 inch) thick. Fabricate glazing beads of aluminum not less than 1.0 mm (0.050 inch) thick.
- B. Accurately form metal parts and accurately fit and rigidly assemble joints, except those joints designed to accommodate movement. Seal joints to prevent leakage of both air and water.
- C. Make welds in aluminum in accordance with the recommended practice AWA D1.2. Use electrodes and methods recommended by the manufacturers of the metals and alloys being welded. Make welds behind finished surfaces so as to cause no distortion or discoloration of the exposed side. Clean welded joints of welding flux and dress exposed and contact surfaces.
- D. Make provisions in doors and frames to receive the specified hardware and accessories. Coordinate schedule and template for hardware specified under Section 08 71 00, DOOR HARDWARE. Where concealed closers or other mechanisms are required, provide the necessary space, cutouts, and reinforcement for secure fastening.
- E. Fit and assemble the work at the manufacturer's plant. Mark work that cannot be permanently plant-assembled to assure proper assembly in the field.

**2.3 PROTECTION OF ALUMINUM:**

- A. Isolate aluminum from contact with dissimilar metals other than stainless steel, white bronze, or zinc by any of the following:
  - 1. Coat the dissimilar metal with two coats of heavy-bodied alkali resistant bituminous paint.
  - 2. Place caulking compound, or non-absorptive tape, or gasket between the aluminum and the dissimilar metal.
  - 3. Paint aluminum in contact with mortar, concrete and plaster, with a coat of aluminum paint primer.

**2.4 FRAMES:**

- A. Fabricate doors, frames, mullions, transoms, frames for fixed glass and similar members from extruded aluminum not less than 3 mm (0.125 inch) thick.
- B. Provide integral stops and glass rebates and applied snap-on type trim.

**SECTION 08 41 13**  
**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

**2.4 FRAMES: (CONT)**

1. Stops square edged not beveled.
- C. Provide section of 4 ½ x2 inch ultra thermal performance .
- D. Use concealed screws, bolts and other fasteners. Secure cover boxes to frames in back of all lock strike cutouts.
- E. Fabricate framework with dual thermal breaks in frames where insulating glass is scheduled and specified under Section 08 80 00, GLAZING.
- F. System U-Value: U-0.35
- G. Design Basis: Kawneer Trifab 451UT series

**2.5 STILE AND RAIL DOORS:**

- A. Nominal 45 mm (1-3/4 inch) thick, with stile and head rail 90 mm (3-1/2 inches) wide, and bottom rail 250 mm (10 inches) wide.
- B. Bevel single-acting doors 3 mm (1/8 inch) at lock, hinge and meeting stile edges. Provide clearances of 2 mm (1/16 inch) at hinge stiles, 3 mm (1/8 inch) at lock stiles and top rails, and 5 mm (3/16 inch) at floors and thresholds. Form glass rebates integrally with stiles and rails. Glazing beads may be formed integrally with stiles and rails or applied type secured with fasteners at 150 mm (six inches) on centers.
- C. Construct doors with a system of welded joints or interlocking dovetail joints between stiles and rails. Clamp door together through top and bottom rails with 9 mm (3/8 inch) primed steel rod extending into the stiles, and having a self-locking nut and washer at each end. Reinforce stiles and rails to prevent door distortion when tie rods are tightened. Provide a compensating spring-type washer under each nut to take up any stresses that may develop. Construct joints between rails and stiles to remain rigid and tight when door is operated.
- D. Weather-stripping: Provide removable, woven pile type (silicone-treated) weather-stripping attached to aluminum or vinyl holder. Make slots for applying weather-stripping integral with doors and door frame stops. Apply continuous weather-stripping to heads, jambs, bottom, and meeting stiles of doors and frames. Install weather-stripping so doors can swing freely and close positively. , interior and exterior.

**2.6 REINFORCEMENT FOR BUILDERS HARDWARE:**

- A. Fabricate from stainless steel plates.
- B. Hinge and pivot reinforcing: 4.55 mm (0.1793 inch) thick.
- C. Reinforcing for lock face, flush bolts, concealed holders, concealed or surface mounted closers: 2.66 mm (0.1046 inch) thick.
- D. Reinforcing for all other surface mounted hardware: 1.5 mm (0.0598 inch) thick.

**2.7 COLUMN COVERS AND TRIM**

- A. Fabricate column covers and trim shown from 1.5 mm (0.0625 inch) thick sheet aluminum of longest available lengths.
- B. Use concealed fasteners.



**SECTION 08 41 13**  
**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

**2.8 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Fluorocarbon Finish: AAMA 605.2, high performance coating.
- C. Custom color

**PART 3 - EXECUTION**

**3.1 INSTALLATION:**

- A. Allowable Installation Tolerances: Install work plumb and true, in alignment and in relation to lines and grades shown. Variation of 3 mm (1/8 inch) in 2400 mm (eight feet), non-accumulative, is maximum permissible for plumb, level, warp, bow and alignment.
- B. Anchor aluminum frames to adjoining construction at heads, jambs and bottom and to steel supports, and bracing. Anchor frames with stainless steel or aluminum countersunk flathead, expansion bolts or machine screws, as applicable. Use aluminum clips for internal connections of adjoining frame sections.
- C. Install hardware specified under Section 08 71 00, DOOR HARDWARE.
- D. Install hung door operators specified under Section 08 71 13, AUTOMATIC DOOR OPERATORS.

**3.2 ADJUSTING:**

After installation of entrance and storefront work is completed, adjust and lubricate operating mechanisms to insure proper performance.

**3.3 PROTECTION, CLEANING AND REPAIRING:**

Remove all mastic smears and other unsightly marks, and repair any damaged or disfiguration of the work. Protect the installed work against damage or abuse.

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**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies glazed aluminum curtain wall system.
  - 1. Thermally isolated, pressure equalized on interior.
  - 2. Type: Stick system to include following:
    - a. Glass Insulated Metal Panels Glass Spandrel Panels .
    - b. Integral reinforcing.
    - c. Closures, trim, subsills and flashings.
    - e. Fasteners, anchors, and related reinforcement.

**1.2 RELATED WORK**

- A. Structural steel: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Miscellaneous metal members: Section 05 50 00, METAL FABRICATIONS.
- C. Sheet metal flashing and trim: Section 07 60 00, FLASHING AND SHEET METAL.
  - a. Joint sealants: Section 07 92 00, JOINT SEALANTS.
- D. Aluminum and glass hinged entry doors and storefront construction: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- E. Aluminum windows: Section 08 51 13, ALUMINUM WINDOWS.
  - 1. Finish Color: Section 09 06 00, SCHEDULE FOR FINISHES.
  - 2. Louvers and wall vents: Section 08 90 00, LOUVERS AND VENTS.

**1.3 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Approval is required of products or service of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
    - a. Manufacturers Qualifications: Manufacturer with five (5) years continuous documented experience in design, fabrication, and installation of glazed aluminum curtain wall systems of type and size required for that project.
    - d. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of glazed aluminum curtain wall system. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, one another, and adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance.
      - 1) Do not modify intended aesthetic effects. If modifications are proposed, submit comprehensive explanatory data for review.
- B. Mockup
  - 1. Construct, at job site, full size typical wall unit which incorporates horizontal and vertical joints, framing, window units, panels, glazing, sealants, and other accessories as detailed and specified. Mock-up wall unit location, size and design shall be as indicated. Orient mockup to be facing full sun when constructed.

**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**1.3 QUALITY ASSURANCE (CONT)**

2. Performance Test
  - a. Conduct performance test after approval of visual aspects has been obtained. Finished work shall match approved mock-up.
  - b. Refer to Performance Requirements and Field Quality Control Articles, included hereinafter, for testing requirements.
3. Approved Mock-up
  - a. After completion and approval of test results of job site mockup, as directed, approved mock-up panel shall be used as minimum standard of comparison for entire curtain wall system.
- C. Pre-Installation Conference
  1. Prior to starting installation of glazed curtain wall system schedule conference with Contracting Officer to ensure following:
    - a. Clear understanding of drawings and specifications.
    - b. Onsite inspection and acceptance of structural and pertinent structural details relating to curtain wall system.
    - c. Coordination of work of various trades involved in providing system. Conference shall be attended by Contractor; personnel directly responsible for installation of curtain wall system, flashing and sheet metal work, fire stopping system and curtain wall manufacturer and their Technical Field Representatives. Conflicts shall be resolved and confirmed in writing.

**1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Product Data:
  1. Manufacturer's standard details and fabrication methods.
  2. Data on finishing, components, and accessories.
  3. Instructions: Submit descriptive literature, detail specifications, available performance test data and instructions for installation, and adjustments.
  4. Recommendations for maintenance and cleaning of exterior surfaces.
- C. Shop Drawings:
  1. Show elevations of glazed curtain wall system at 1:50 (1/4 inch) scale, metal gages, details of construction, methods of anchorage, glazing details, and details of installation.
  2. Submit for curtain wall system, accessories, and mock-up . Tentative approval of drawings shall be received before fabrication of mock-up. Final approval of drawings shall be deferred pending approval of mock-up and accessories. Drawings shall indicate in detail all system parts including elevations, full size sections, framing, jointing, panels, types and thickness of metal anchorage details, flashing and coping details, field connections, weep and drainage system, finishes, sealing methods, glazing, glass sizes and details, firestopping insulation materials, and erection details.
  3. Operation and Maintenance Manuals
    - a. Submit cleaning and maintenance instructions.

**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**1.4 SUBMITTALS (CONT)**

- D. Samples:
  - 1. Submit pairs of samples of each specified color and finish on 300 mm (12-inch) long section by width of each tubular, or extruded shape section or 300 mm by 300 mm (12-inch by 12-inch) wide sections of sheet shapes.
- E. Glass:
  - 1. Specified in Section 08 80 00, GLAZING.
- F. Quality Control Submittals:
  - 1. Design Data:
    - a. Submit structural and thermal calculations for complete wall assembly. Structural calculations and design shop drawings shall be signed and sealed by a structural engineer registered in state in which project is to be located.
  - 2. Factory Test Reports:
    - a. Test Reports: Provide certified test reports, for each of following listed tests, from a qualified independent testing laboratory showing that glazed aluminum curtain wall system assembly has been tested in accordance with specified test procedures and complies with performance characteristics as indicated by manufacturer's testing procedures. Manufacturer shall submit appropriate testing numbers for specific tests indicated below.
      - 1) Deflection and structural tests.
      - 2) Water penetration tests.
      - 3) Air infiltration tests.
      - 4) Delamination tests.
      - 5) Thermal conductance tests.
      - 6) Submit factory tests required except that where a curtain wall system or component of similar type, size, and design as specified for this project has been previously tested within last year, under conditions specified herein, resulting test reports may be submitted in lieu of listed testing.
- G. Manufacturer's Certificates:
  - 1. Submit Certificates of Compliance, with specification requirements.
- H. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.
- B. Prior to packaging for shipment from factory, mark wall components to correspond with shop and erection drawings and their placement location and erection.
- C. Prior to shipment from factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of members with protective covering of adhesive paper, waterproof tape,

**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**1.5 DELIVERY, STORAGE AND HANDLING (CONT)**

or strippable plastic. Do not cover metal surfaces that will be in contact with sealants after installation.

- D. Inspect materials delivered to site for damage; unload and store with ventilation, free from heavy dust, not subject to combustion products or sources of water, and shall permit easy access for inspection and handling. Sealing and caulking compounds, including handling, shall be in accordance with requirements of Section 07 92 00 JOINT SEALANTS.

**1.6 PROJECT CONDITIONS**

Field Measurements: Where glazed aluminum curtain wall systems are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
- MCWM-1-89 ..... Metal Curtain Wall Manual
  - CWG 1-89 ..... Installation of Aluminum Curtain Walls
  - TIR A9-91 ..... Metal Curtain Wall Fasteners
  - TIR A11-04 ..... Maximum Allowable Deflection of Framing Systems for Building Cladding Components of Design Wind Loads
  - 501-05 ..... Methods of Test for Exterior Walls
  - 503-08 ..... Field Testing of Metal Storefronts, Curtain walls and Sloped Glazing Systems
  - 2605-98 ..... High Performance Organic Coatings on Architectural Extrusions and Panels
  - 1503-09 ..... Thermal Transmission and Condensation Resistance of Windows, Doors and Glazed Wall Sections
- C. American National Standards Institute (ANSI):
- Z97.1-09 ..... Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test
- E. American Society for Testing and Materials (ASTM):
- A123-09 ..... Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - B209-10 ..... Aluminum and Aluminum Alloy Sheet and Plate
  - B211-03 ..... Aluminum and Aluminum Alloy Bar, Rod, Wire
  - B221/B221M-08 ..... Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
  - B316/B316M-10 ..... Aluminum and Aluminum Alloy Rivet and Cold-Heading, Wire, and Rods
  - C920-11 ..... Elastomeric Joint Sealants
  - E283-04 ..... Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Difference Across this Specification

**SECTION 08 44 13  
GLAZED ALUMINUM CURTAIN WALLS**

**1.7 APPLICABLE PUBLICATIONS (CONT)**

- E330-02(R2010) .....Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
- E331-00(R2009) .....Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference
- E783-02(R2010) .....Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
- E1105-00(R2008) .....Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors By Uniform or Cyclic Static Air Pressure Differences
- F. American Welding Society, Inc. (AWS):
  - D1.2-08 .....Structural Welding Code-Aluminum
- G. Consumer Product Safety Commission (CPSC):
  - 16 CFR 1201.....Architectural Glazing Standards and Related Material
- I. Glass Association of North America (GANA):
  - 2010 Edition .....GANA Glazing Manual
  - 2008 Edition .....GANA Sealant Manual
  - 2009 Edition .....GANA Laminated Glazing Reference Manual
  - 2008 Edition .....Tempered Glass Engineering Standard Manual
- K. National Association of Architectural Metal Manufacturers (NAAMM):
  - 500 Series (2006) .....Metal Finishes Manual.

**1.8 WARRANTY**

- A. Submit manufacturer's written warranty for materials, installation and weathertightness, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to five (5) years from date of final acceptance of project by Government.

**PART 2 - PRODUCTS**

**2.1 SYSTEM DESCRIPTION**

- A. Design Requirements:
  - 1. Curtain Wall System: Tubular aluminum sections with thermal break condition self supporting framing, factory prefinished, vision glass, glass spandrel infill, related flashings, anchorage and attachment devices.
  - 2. System Assembly: Site assembled.
  - 3. No curtain wall framing member shall deflect, in a direction normal to plane of wall, more than 1/175 of its clear span or 20 mm (3/4 inch), whichever is less, when designed in accordance with requirements of TIR A11 and tested in accordance with ASTM E330, except that when a gypsum wallboard surface will be affected, deflection shall not exceed 1/360 of span. No framing member shall have a permanent deformation in excess of 0.2 percent of its clear span when tested in accordance with ASTM E330 for a minimum test period of 10 seconds at 1.5 times design wind pressures indicated as part of structural drawing wind load requirements. No glass breakage, damage to fasteners, hardware or accessories shall be permitted due to deformation stated above:

**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**2.1 SYSTEM DESCRIPTION (CONT)**

- a. Provide system complete with framing, mullions, trim, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing wall to structure as specified or indicated. Unless noted otherwise, comply with MCWM-1.
  - b. Curtain wall system components and integral door and/or window units shall be furnished by one manufacturer or fabricator; however, all components need not be products of same manufacturer.
  - c. Fully coordinate system accessories directly incorporated, and adjacent to contiguous related work and insure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified.
  - d. Provide system with adequate allowances for expansion and contraction of components and fastenings to prevent buckling damage, joint seal failure, glass breakage, undue stress on fastenings or other detrimental effects. For design purposes, base provisions for thermal movement on assumed ambient temperature range of from -18 degrees C to 49 degrees C (0 degrees F to 120 degrees F).
  - e. Provide wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified.
  - f. Provide Section of 2 ½ x 6 inch outside glazed, thermally broken
  - f. System U-Value: U-0.35
  - g. Basis of Design : Kawneer 1600UT Curtain Wall System 1 or 2
- B. Manufacturer's Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of curtain walls that are similar to those indicated for this Project in material, design, and extent.
- C. Performance Requirements:
1. System shall meet or exceed all performance requirements specified.
  2. Curtain wall components shall have been tested in accordance with requirements below and shall meet performance requirements specified:
  3. System Design: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall as calculated in accordance with ICC/IBC code. as calculated in accordance with ASCE 7-Minimum Design Loads for Buildings and Other Structures. to a design pressure of 80 lb/sq ft) as measured in accordance with ASTM E330.
  4. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with current OSSC code.
  5. Water Penetration:
    - a. No water penetration shall occur when wall is tested in accordance with ASTM E331 at a differential static test pressure of 20 percent of inward acting design wind pressure as indicated on structural drawings, but not less than 479 Pa (10 psf).
    - b. Make provision in wall construction for adequate drainage to outside of water leakage or condensation that occurs within outer face of wall. Leave drainage and weep openings in members and wall open during test.
  6. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783
    - a. Static-Air-Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.



**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**2.1 SYSTEM DESCRIPTION (CONT)**

- b. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq ft) of surface maximum.
- 7. Deflections Test: ASTM E330, Procedure B:
  - a. No member shall deflect in a direction parallel to plane of wall, when carrying its full design load, more than an amount which will reduce edge cover or glass bite below 75 percent of design dimension. No member after deflection under full design load, shall have a clearance between itself and top of panel, glass, sash, or other part immediately below it less than 3 mm (1/8 inch); clearance between member and an operable window or door shall be minimum 1.5 mm (1/16 inch).
- 8. Delamination Test:
  - a. Adhesively bonded metal-faced panels shall show no evidence of delamination, warpage or other deterioration or damage when subjected to the six "Accelerated Aging Cycles" specified in ASTM D1037.
- 9. Thermal Conductance Tests: ASTM C236.
  - a. The thermal transmittance of opaque panels shall not exceed a U-value, Btu/hr/sq ft/degree F, as required and indicated on contract drawings for exterior wall system, when tested in accordance with ASTM C236. Average calculated thermal transmittance of complete wall assembly including panels, windows, and all other components shall not exceed a U-value of 0.35.
- 10. Window Tests:
  - a. Windows shall meet the requirements specified in Section 08 51 13 ALUMINUM WINDOWS except where requirements of this section differ, this section shall govern. Windows shall meet same requirements for deflection and structural adequacy as specified for framing members when tested in accordance with ASTM E330 except permanent deformation shall not exceed 0.4 percent; there shall be no glass breakage, and no permanent damage to fasteners, anchors, hardware, or operating devices. Windows shall have no water penetration when tested in accordance with requirements of ASTM E331.
- 11. Sound Attenuation Through Wall System (Exterior to Interior):
  - a. STC50 measured in accordance with ASTM E413.

**2.2 MATERIALS**

- A. Extruded Aluminum Framing Members: ASTM B221M; 6063-T5 extruded aluminum for non-structural components or 6063-T6 extruded aluminum for structural members; temper and alloy as recommended by manufacturer.
- B. Sheet Aluminum: ASTM B209M; 6065-T5 temper and alloy as recommended by manufacturer.
  - 1. Formed flashing and closures: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.
  - 2. Extruded sill members: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.
- C. Steel Sections: ASTM A36M.
- D. Primer: TS TT-P-645; red, for shop application and field touch-up.
- E. Fasteners:
  - 1. For Exterior Cap Retainers: ASTM A193 B8 300 series, stainless steel screws.
  - 2. For Framework Connections: ASTM B211M 2024-T4 aluminum, ASTM A193 B8 300 series, stainless steel, and ASTM B316 aluminum rivets, as required by connection.

**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**2.2 MATERIALS (CONT)**

3. For Anchoring Glazed Aluminum Curtain Wall to Support Structure: ASTM A307 zinc plated steel fasteners.
  - a. Fiberglass pressure plates
- F. Shims: Metal or plastic.
- G. Joint Sealants and Accessories:
  1. In accordance with requirements specified in Section 07 92 00, JOINT SEALANTS.
  2. Structural Flush Glazed Joints: High performance silicone sealant applied in accordance with manufacturer's recommendations.
  3. Non-structural Flush Glazed Joints and Weather Seal Joints: Silicone sealants applied in accordance with manufacturer's recommendations.
  4. Structural silicone sealant performance requirements: ASTM C920.
    - a. Hardness: Type A, 30 durometer.
    - b. Ultimate Tensile Strength: 1172 kPa (170 psi).
    - c. Tensile at 150% Elongation: 55 kPa (80 psi).
    - d. Joint Movement Capability after 14 Day Cure: +/- 50%.
    - e. Peel Strength aluminum, after 21 Day Cure: 599 g/mm (34 pounds per inch).
  5. Structural silicone shall not be used to support dead weight of vertical glass or panels.
  6. Comply with recommendations of sealant manufacturer for specific sealant selections.
  7. Provide only sealants that have been tested per ASTM C794 to exhibit adequate adhesion to samples of glass and metal equivalent to those required for project.
  8. Exposed metal to metal joints: Silicone sealant selected from manufacturer's standard colors.
- H. Glazing Materials:
  1. As specified under Section 08 80 00, GLAZING.
  2. Glazing Gaskets:
    - a. Exterior: Continuous EPDM gaskets at each glass and spandrel panel.
    - b. Interior: Continuous, closed cell PVC foam sealant tape, sealed at corners.
    - c. Polymer Thermal Separator
  3. Glass Sizes and Clearances:
    - a. Accommodate up to 25 mm (1 inch) glazing.
    - b. Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip glass to remove flares or to reduce oversized dimensions. All cutting shall occur in factory.
  4. Glass Setting Materials:
    - a. Provide head bead and drive wedge required for glass installation to suit curtain wall system in accordance with manufacture's recommendations.
    - b. If used in psychiatric facilities, the glass shall be retained in the framing system in such a manner that it can withstand lateral forces in excess of force required to break the glass. Plastic clips for holding glass are not permitted.

**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**2.3 FABRICATION**

- A. Curtain wall components shall be of materials and thickness indicated or specified. Details indicated are representative of required design and profiles. Maintain sightlines indicated on drawings. Unless specifically indicated or specified otherwise, methods of fabrication and assembly shall be at discretion of curtain wall manufacturer. Perform fitting and assembling of components in shop to maximum extent practicable. Anchorage devices shall permit adjustment in three directions. There shall be no exposed fasteners.
- B. Joints: Joints exceeding +1.5 mm (+1/16") shall be mechanically fastened.
- C. Ventilation and Drainage: Direct water leakage to exterior by means of concealed drainage system and weeps. Flashings and other materials used internally shall be nonstaining, noncorrosive, and nonbleeding.
- D. Protection and Treatment of Metals:
  - 1. Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving shop.
  - 2. Provide protection against galvanic action wherever dissimilar metals are in contact, except in case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint conforming to MIL-C-18480 or apply appropriate caulking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.
- E. Metal sills and Closures: Fabricate accessories, spandrel panels, trim closures of sizes and shapes indicated from similar materials and finish as specified for wall system.
  - 1. Stops to be square not beveled.
- F. Concealed Interior Mullion Reinforcing: ASTM A36M steel shapes as required for strength and mullion size limitations, hot dip galvanized after fabrication in accordance with ASTM A123.
- G. Metal Spandrel Panels: Manufacturer's standard laminated aluminum-faced panels of thickness indicated, flat with no deviations in plane exceeding 1.5 mm in 600 mm (1/16 inch in 24 inches) or 3 mm (1/8 inch) over entire panel. Provide with edge flanges:
  - 1. Face Sheets: 0.6 mm (0.024-inch) minimum thickness finished to match system framing.
    - a. Texture: Smooth.
  - 2. Concealed Back Sheets: Aluminum or galvanized steel in manufacturer's standard thickness.
- H. Stabilizer Sheets:
  - 1. 3 mm (1/8 inch) thick tempered hardboard.
  - 2. 13 mm (1/2 inch) thick gypsum board.
  - 3. Gypsum board at inner face and hardboard at outer face as required to provide surface burning characteristics when tested according to ASTM E84 as follows:
- I. Panel Core Material:
  - 1. Extruded-polystyrene thermal insulation complying with ASTM C578, Type IV requirements: R-Value: R19.
  - 2. Edge Configuration: Sealed.

**2.4 PROTECTION**

- A. Provide protection for aluminum against galvanic action, wherever dissimilar materials are in contact, by painting contact surfaces of dissimilar material with a heavy coat of bituminous paint (complete coverage), or by separating contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on one side.

**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**2.5 METAL FINISHES**

- A. In accordance with NAAMM AMP500 series.
- B. Fluorocarbon Finish: AAMA 2605.
  - 1. Color custom.
- C. Shop and Touch-Up Primer for Steel Components: SSPC Paint 25 red oxide.
- D. Concealed Steel Items: Galvanized in accordance with ASTM A123 to 610 Primed with iron oxide paint.
- E. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Prior to installation of glazed curtain wall system, arrange for representative(s) of manufacturer to examine structure and substrate to determine that they are properly prepared, and ready to receive glazed curtain wall work included herein.
- B. Verifying Conditions and Adjacent Surfaces: After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in building frame.

**3.2 PREPARATION**

- A. Take field dimensions and examine condition of substrates, supports, and other conditions under which work of this section is to be performed to verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Contact between aluminum and dissimilar metals shall receive a protective coating of asphaltic paint for prevention of electrolytic action and corrosion.

**3.3 INSTALLATION**

- A. Installation and erection of glazed curtain wall system and all components shall be in accordance with written directions of curtain wall manufacturer. Match profiles, sizes, and spacing indicated on approved shop drawings.
- B. Bench Marks and Reference Points: Establish and permanently mark bench marks for elevations and building line offsets for alignment at convenient points on each floor level. Should any error or discrepancy be discovered in location of marks, stop erection work in that area until discrepancies have been corrected.
- C. Ensure that drainage system operates properly in accord with AAMA 501 procedures.
- D. Do not proceed with structural silicone work when metal temperature is below 0 degrees C (32 degrees F).
- E. Isolate between aluminum and dissimilar metals with protective coating or plastic strip to prevent electrolytic corrosion.
- F. Install glazed aluminum curtain wall system so as to maintain a virtually flat face cap, with no visible bowing.
- G. Install entire system so that fasteners are not visible.

**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**3.3 INSTALLATION (CONT)**

H. Tolerances:

1. Maximum variation from plane or location shown on approved shop drawings: 3 mm per 3600 mm (1/8 inch per 12 feet) of length up to not more than 13 mm (1/2 inch) in any total length.
2. Maximum offset from true alignment between two identical members abutting end to end in line: 0.8 mm (1/32 inch).
3. Sealant Space Between Curtain Wall Mullion and Adjacent Construction: Maximum of 19 mm (3/4 inch) and minimum of 6 mm (1/4 inch).

I. Windows:

1. Refer to Section 08 51 13, ALUMINUM WINDOWS.
2. Install windows in accordance with details indicated and approved shop drawing detail drawings.
3. Seal exterior metal to metal joints between members of windows, frames, mullions, and mullion covers in accordance with requirements of Section 07 92 00, JOINT SEALANTS. Remove excess sealant.
4. After installing and glazing windows, adjust ventilators and hardware to operate smoothly and to be weathertight when ventilators are closed and locked. Lubricate hardware and moving parts.
5. Install to make weathertight contact with frames when ventilators are closed and locked. Do not cause binding of sash or prevent closing and locking of ventilator.
  - a. Provide for ventilating sections of all windows to insure a weather-tight seal meeting infiltration tests specified. Use easily replaceable factory-applied weather-stripping of manufacturer's stock type.

J. Joint Sealants:

1. Joint Sealants: Shall be part of curtain wall work and System.
2. Surfaces to be primed and sealed shall be clean, dry to touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out grooves to proper depth. Joint dimensions shall conform to approved detail drawings with a tolerance of plus 3 mm (1/8 inch). Do not apply compound unless ambient temperature is between 5 and 35 degrees C (40 and 90 degrees F). Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents used to remove coatings shall be of type that leave no residue on metals.
3. Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound shall be uniformly smooth and free of wrinkles and, unless indicated otherwise, shall be tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four hours, but at no time shall this amount exceed 19 liters (5 gallons).
4. Apply primer to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after caulking is completed.

**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**3.3 INSTALLATION (CONT)**

5. Tightly pack backing in bottom of joints which are over 13 mm (1/2 inch) in depth with specified backing material to depth indicated or specified. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.
6. Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.
7. Remove compound smears from surfaces of materials adjacent to sealed joints as work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with approved solvent. Upon completion of caulking and sealing, remove remaining smears, stains, and other soiling, and leave work in clean neat condition.

**K. Glass:**

1. Refer to Section 08 80 00, GLAZING, and drawing for glass types. Install in accordance with manufacturer's recommendations as modified herein.
2. Before installing glass, inspect sash and frames to receive glass for defects such as dimensional variations, glass clearances, open joints, or other conditions that will prevent satisfactory glass installation. Do not proceed with installation until defects have been corrected.
3. Clean sealing surfaces at perimeter of glass and sealing surfaces of rebates and stop beads before applying glazing compound, sealing compound, glazing tape, or gaskets. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer. All sashes shall be designed for outside glazing. Provide continuous snap in glazing beads to suit glass as specified.
4. Insulating and tempered glass, and glass of other types that exceed 100 united inches in size: Provide void space at head and jamb to allow glass to expand or move without exuding sealant. Perimeter frames and ventilator sections shall have glazing rebates providing an unobstructed glazing surface 19 mm (3/4 inch) in height. Glazing rebate surfaces must be sloped to shed water.
5. Provide adequate means to weep incidental water and condensation away from sealed edges of insulated glass units and out of wall system. Weeping of lock-strip gaskets should be in accordance with recommendation of glass manufacturer.

**L. Metal Copings:**

1. Refer to Section 07 60 00, FLASHING AND SHEET METAL for requirements of metal copings when they are not a part of glazed curtain wall system work.
2. Coordinate curtain wall installation with metal coping detail on contract drawings. Provide watertight seal to meet criteria set forth in this section regarding air and water penetration.

**3.4 ADJUSTING**

- A. Adjust windows and doors to provide a tight fit at contact points and operate easily.
- B. Adjust weather-stripping to make even contact with surfaces.
- C. Adjust operating hardware and moving parts.

**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**3.5 CLEANING**

- A. Install curtain wall frame and associated metal to avoid soiling or smudging finish.
- B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Follow recommendations of manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
- E. Replace cracked, broken, and defective glass with new glass at no additional cost to Government. Just prior to final acceptance of curtain wall system clean glass surfaces on both sides, remove labels, paint spots, compounds, and other defacements, and clean metal fixed panels. Remove and replace components that cannot be cleaned successfully.

**3.6 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage an AAMA accredited commercial qualified independent testing and inspecting agency to perform field quality-control tests specified, and to prepare test reports: Submit information regarding testing laboratory's facilities and qualifications of technical personnel to Contracting Officer for approval.
- B. Conduct field check test for water leakage on designated wall areas after erection to comply with MCWM-1. Conduct test on two wall areas, two bays wide by two stories high where directed. Conduct test and take necessary remedial action as directed by Contracting Officer.
- C. Test Specimen:
  - 1. Test specimen shall include curtain wall assembly and construction. Test chamber shall be affixed to exterior side of test specimen and test shall be conducted using positive static air pressure.
  - 2. Test specimens shall be selected by Contracting Officer after curtain wall system has been installed in accordance with contract drawings and specification.
- D. Sealant Adhesion Tests: Test installed sealant, in presence of sealant manufacturer's field representative, in a minimum of two areas and as follows:
  - 1. Test structural silicone sealant according to field adhesion test method described in AAMA CW 13, "Structural Sealant Glazing Systems (A Design Guide)."
  - 2. Test weatherseal sealant as recommended in writing by sealant manufacturer.
- E. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783.
  - 1. Field air leakage testing is not required for continuous curtain wall systems.
  - 2. Static-Air-Pressure Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
  - 3. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq. ft.) of surface maximum.
- F. Water Penetration: Test glazed aluminum curtain wall system for compliance with requirements according to AAMA 503, which requires testing according to ASTM E1105.
  - 1. Uniform Static-Air-Pressure Difference: 20 percent of positive design wind load, but not less than 479 Pa (10 psf). No uncontrolled water shall be present.
- G. Retesting:
  - 1. Should system fail field test, system may be modified or repaired, and retested.
  - 2. Should system fail second field test, system may be additionally modified or repaired, and retested.
  - 3. All modifications and repairs made to tested areas shall be recorded, and same modifications and repairs made to all system and adjacent construction on project.

**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**3.6 FIELD QUALITY CONTROL (CONT)**

4. Should second test fail, Contracting Officer may require testing of additional areas of the curtain wall.
- H. Rejection:
1. Failure of any of specimens to meet test requirements of third test shall be cause for rejection of wall system and adjacent construction on project

**3.7 DEMONSTRATION, TESTING, AND ACCEPTANCE**

- A. Instruct Owner's personnel in proper operation and maintenance of windows. Train personnel in procedures to follow in event of operational failures or malfunctions.
- B. Acceptance: At completion of project, and as a condition of acceptance, systems shall be operated for a period of fifteen (15) consecutive calendar days without breakdown.

**3.8 PROTECTION**

- A. After installation, protect windows, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods shall be in accordance with recommendations of product manufacturers or of respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or respective trade association.

- - - END - - -



**SECTION 08 51 13  
ALUMINUM WINDOWS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Aluminum windows of type and size shown, complete with hardware, related components and accessories.
- B. Types:
  - 1. Projected
  - 2. Fixed

**1.2 DEFINITIONS**

- A. Accessories: Mullions, casings, closures, trim , panning systems, sub-sills, clips anchors, fasteners, weather-stripping, insect screens and other necessary components required for fabrication and installation of window units.
- B. Uncontrolled Water: Water not drained to the exterior, or water appearing on the room side of the window.

**1.3 RELATED WORK**

- A. Steel subframes: Section 05 50 00, METAL FABRICATIONS.
- B. Storefront: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- C. Glazing: Section 08 80 00, GLAZING.
- D. Color of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.4 DELIVERY, STORAGE AND HANDLING**

- A. Protect windows from damage during handling and construction operations before, during and after installation.
- B. Store windows under cover, setting upright.
- C. Do not stack windows flat.
- D. Do not lay building materials or equipment on windows.

**1.5 QUALITY ASSURANCE**

- A. Approval by contracting officer is required of products or service of proposed manufacturers and installers.
- B. Quality Certified Labels or certificate:
  - 1. Architectural Aluminum Manufacturers Association, "AAMA label" affixed to each window indicating compliance with specification.

**1.6 SUBMITTAL**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Minimum of 1/2 full scaletypes of windows on project
  - 2. Include glazing details and standards for factory glazed units.

**SECTION 08 51 13  
ALUMINUM WINDOWS**

**1.6 SUBMITTAL (CONT)**

- C. Manufacturer's Literature and Data:
  - Window.
  - Sash locks, keepers, and key.
- D. Certificates:
  - 1. Manufacturer's Certification that windows delivered to project are identical to windows tested.
- E. Samples: Provide 150 mm (six-inch) length samples showing finishes, specified.
- F. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.7 WARRANTY**

Warrant windows against malfunctions due to defects in thermal breaks, hardware, materials and workmanship, subject to the terms of Article "WARRANTY OF CONSTRUCTION", FAR clause 52.246-21, except provide 10 year warranty period.

**1.8 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)  
90.1-07 .....Energy Standard of Buildings
- C. American Architectural Manufacturers Association (AAMA):  
101/IS.2/ A440-08.....Windows, Doors, and Unit Skylights  
505-09 .....Dry Shrinkage and Composite Performance Thermal Cycling Test Procedures  
2605-05 .....Superior Performing Organic Coatings on Architectural Aluminum Extrusions and Panels  
TIR-A8-08 .....Structural Performance of Poured and Debridged Framing Systems
- D. American Society for Testing and Materials (ASTM):  
A653/ A653M-09.....Steel Sheet, Zinc Coated (Galvanized), Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-dip Process
- E. National Fenestration Rating Council (NFRC):  
NFRC 100-10 .....Determining Fenestration Product U-Factors  
NFRC 200-10 .....Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
- F. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06.....Metal Finishes Manual

**SECTION 08 51 13**  
**ALUMINUM WINDOWS**

**PART 2- PRODUCTS**

**2.1 MATERIALS**

- A. Aluminum Extrusions; Sheet and Plate: AAMA 101/I.S.2.
- B. Sheet Steel, Galvanized: ASTM A653; G90 galvanized coating.
- C. Weather-strips: AAMA 101/I.S.2; except leaf type weather-stripping is not permitted.
- D. Insect Screening:
  - 1. Regular mesh, 18 by 18, AAMA 101/I.S.2.
  - 2. Aluminum with dark bronze anodized finish unless specified otherwise.
- E. Fasteners: AAMA 101/I.S.2. Screws, bolts, nuts, rivets and other fastening devices to be non-magnetic stainless steel.
  - 1. Fasteners to be concealed when window is closed. Where wall thickness is less than 3 mm (0.125 inch) thick, provide backup plates or similar reinforcements for fasteners.
  - 2. Stainless steel self tapping screws may be used to secure Venetian blind hanger clips, vent guide blocks, friction adjuster, and limit opening device.
  - 3. Attach locking and hold-open devices to windows with concealed fasteners. Provide reinforcing plates where wall thickness is less than 3 mm (0.125 inch) thick.
- F. Weather-strips: AAMA 101/I.S.2.
- G. Hardware:
  - 1. Locks: Two position locking bolts or cam type tamperproof custodial locks with a single point control located not higher than five feet from floor level. Locate locking devices in the vent side rail. Fastenings for locks and keepers shall be concealed or nonremovable.
  - 2. Fabricate hinges of noncorrosive metal. Hinges may be either fully concealed when window is closed or semi-concealed with exposed knuckles. All exposed knuckle hinges shall have hospital tips, at both ends. Surface mounted hinges will not be accepted.
  - 3. Guide Blocks: Fabricate guide blocks of injection molded nylon. Install guide block fully concealed in vent/frame sill.
  - 4. Hardware for Emergency Ventilation of Windows:
    - a. Provide windows with a hold open linkage for emergency ventilation.
    - b. Hold open hardware shall provide for maximum six inches of window opening and shall include an adjustable friction shoe to provide resistance when closing the window.
    - c. Handles shall be removable.
  - 6. Hardware for Maintenance Opening of Windows: Opening beyond the six inch position shall be accomplished with a window washers key. The release device shall capture the key when window is in the open position.
  - 7. Design operating device to prevent opening with standard tools, coins or bent wire devices.

**2.2 THERMAL AND CONDENSATION PERFORMANCE**

- A. Condensation Resistance Factor (CRF): Minimum CRF of C 50.
- B. Thermal Transmittance:
  - 1. Maximum U value class for insulating glass windows: 50 (U=0.50).
  - 2. Maximum U value class for dual glazed windows: 70 (U=0.70), or as required by ASHRAE 90.1.
- C. Solar Heat Gain Coefficient (SHGC): SHGC shall comply with State or local energy code requirement.

**SECTION 08 51 13**  
**ALUMINUM WINDOWS**

**2.3 FABRICATION**

- A. Fabrication to exceed or meet requirements of Physical Load Tests, Air Infiltration Test, and Water Resistance Test of AAMA 101/I.S.2.
- B. Glazing:
  - 1. Factory or field glazing optional.
  - 2. Glaze in accordance with Section 08 80 00, GLAZING.
  - 3. Windows reglazable without dismantling sash framing.
  - 4. Design rabbet to suit glass thickness and glazing method specified5. Glaze from interior except where not accessible.
  - 5. In Security Bedrooms and Security Psychiatric Nursing Units, glaze from outside, except where detention screens occur, or cavity side of dual glazed windows.
  - 6. Provide removable fin type glazing beads.
- C. Trim:
  - 1. Trim includes casings, closures, and panning.
    - a. Glass Stops square edged not beveled
  - 2. Extruded or formed sections, straight, true, and smooth on exposed surfaces.
  - 3. Exposed external corners mitered and internal corners coped; fitted with hairline joints.
  - 4. Reinforce 1.6 mm (0.062 inch) thick members with not less than 3 mm (1/8-inch) thick aluminum.
  - 5. Except for strap anchors, provide reinforcing for fastening near ends and at intervals not more than 305 mm (12 inches) between ends.
  - 6. Design to allow unrestricted expansion and contraction of members and window frames.
  - 7. Secure to window frames with machine screws or expansion rivets.
  - 8. Exposed screws, fasteners or pop rivets are not acceptable on exterior of the casing or trim cover system.
- D. Thermal-Break Construction:
  - 1. Manufacturer's Standard.
  - 2. Low conductance thermal barrier.
  - 3. Capable of structurally holding sash in position and together.
  - 4. All Thermal Break Assemblies (Pour & Debridge, Insulbar or others) shall be tested as per AAMA TIR A8 and AAMA 505 for Dry Shrinkage and Composite Performance.
  - 5. Location of thermal barrier and design of window shall be such that, in closed position, outside air shall not come in direct contact with interior frame of the window.
- E. Mullions: AAMA 101.
- F. Subsills and Stools:
  - 1. Fabricate to shapes shown of not less than 2 mm (0.080 inch) thick extruded aluminum.
  - 2. One piece full length of opening with concealed anchors.
  - 3. Sills turned up back edge not less than 6 mm (1/4 inch). Front edge provide with drip.
  - 4. Sill back edge behind face of window frame. Do not extend to interior surface or bridge thermal breaks.
  - 5. Do not perforate for anchorage, clip screws, or other requirements.
- G. Insect Screens:
  - 1. AAMA 101/I.S.2.
  - 2. Aluminum screen cloth.
  - 3. Do not tilt-in sash without use of a maintenance only release mechanism and removable locking handle. Finger operated tilt latches not acceptable.

**SECTION 08 51 13  
ALUMINUM WINDOWS**

**2.3 FABRICATION (CONT)**

- H. Product: Match Curtain Wall and Storefront Sections in size, shape and finish.
1. Manufacturer to be the same as Curtain Wall and Storefront System.
  2. Design Basis Kawneer Tri-Fab 451T

**2.4 PROJECTED WINDOWS**

- A. AAMA 101/I.S.2; Type: C-H65
- B. AAMA certified product to the AAMA 101/I.S.2. - 97 standard.
- C. Operation:
  1. Upper ventilators: Project-out and slide down from top.
  2. Hopper vents: Project-in from top and slide up from bottom.

**2.5 FIXED WINDOWS**

- A. AAMA 101/I.S.2; Type: HC25
- B. AAMA certified product to the AAMA 101/I.S.2. - 97 standard.

**2.6 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Finish exposed aluminum surfaces as follows:
  1. Anodized Aluminum:
    - a. Colored anodized Finish: AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1 Architectural, 0.7 mils thick.
  - 1) Coated Aluminum:
  - 2) Variation of more than 50 percent of maximum shade range approved will not be accepted in a single window or in adjacent windows and mullions on a continuous series.
    - a) AMP 501 and 505.
    - b) Fluorocarbon Finish: AAMA 2605, superior performing organic coating.
- C. Hardware: Finish hardware exposed when window is in the closed position: Match window color.

**PART 3 - EXECUTION**

**3.1 PROTECTION (DISSIMILAR MATERIALS):**

AAMA 101/I.S.2.

**3.2 INSTALLATION, GENERAL**

- A. Install window units in accordance with manufacturer's specifications and recommendations for installation of window units, hardware, operators and other components of work.
- B. Where type, size or spacing of fastenings for securing window accessories or equipment to building construction is not shown or specified, use expansion or toggle bolts or screws, as best suited to construction material.
  1. Provide bolts or screws minimum 6 mm (1/4-inch) in diameter.

**SECTION 08 51 13  
ALUMINUM WINDOWS**

**3.2 INSTALLATION, GENERAL (CONT)**

2. Sized and spaced to resist the tensile and shear loads imposed.
3. Do not use exposed fasteners on exterior, except when unavoidable for application of hardware.
4. Provide non-magnetic stainless steel Phillips flat-head machine screws for exposed fasteners, where required, or special tamper-proof fasteners.
5. Locate fasteners to not disturb the thermal break construction of windows.
- C. Set windows plumb, level, true, and in alignment; without warp or rack of frames or sash.
- D. Anchor windows on four sides with anchor clips or fin trim.
  1. Do not allow anchor clips to bridge thermal breaks.
  2. Use separate clips for each side of thermal breaks.
  3. Make connections to allow for thermal and other movements.
  4. Do not allow building load to bear on windows.
  5. Use manufacturer's standard clips at corners and not over 600 mm (24 inches) on center.
  6. Where fin trim anchorage is shown build into adjacent construction, anchoring at corners and not over 600 mm (24 inches) on center.

**3.3 MULLIONS CLOSURES, TRIM, AND PANNING**

- A. Cut mullion full height of opening and anchor directly to window frame on each side.
- B. Closures, Trim, and Panning: External corners mitered and internal corners coped, fitted with hairline, tightly closed joints.
- C. Secure to concrete or solid masonry with expansion bolts, expansion rivets, split shank drive bolts, or powder actuated drive pins.
- D. Screwed to wood or metal.
- E. Fasten except for strap anchors, near ends and corners and at intervals not more than 300 mm (12 inches) between.
- F. Seal units following installation to provide weathertight system.

**3.4 ADJUST AND CLEAN**

- A. Adjust ventilating sash and hardware to provide tight fit at contact points, and at weather-stripping for smooth operation and weathertight closure.
- B. Clean aluminum surfaces promptly after installation of windows, exercising care to avoid damage to protective coatings and finishes.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Lubricate hardware and moving parts.
- E. Clean glass promptly after installation of windows. Remove glazing and sealant compound, dirt and other substances.
- F. Except when a window is being adjusted or tested, keep locked in the closed position during the progress of work on the project.

**3.5 OPERATION DEVICES**

- A. Provide wrenches, keys, or removable locking operating handles, as specified to operate windows.

- - - E N D - - -

**SECTION 08 56 19  
PASS WINDOWS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies sliding glass counter mounted pass windows.

**1.2 RELATED WORK**

- A. Color of factory finish: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Glass and Glazing: Section 08 80 00, GLAZING.

**1.3 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extend referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - B221/221M-08.....Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Shapes and Tubes (Metric)
  - C509-06 .....Elastomeric Cellular Preformed Gasket and Sealing Material
- C. American Society of Mechanical Engineers (ASME):
  - B18.6.4-98(R2005) ..... Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws
- D. Master Painters Institute (MPI):
  - MPI #18 .....Organic Zinc Rich Coating
- E. National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series.....Metal Finishes Manual
  - AMP 500 .....Introduction to Metal Finishing
  - AMP 501 .....Finishes for Aluminum

**1.4 EXTENT OF WORK**

- A. Provide at Pharmacy and Ward Clerk and shown on drawings.

**PART 2 - PRODUCTS**

**2.1 MATERIAL**

- A. Aluminum Extrusions:
  - 1. ASTM B 221 M.
  - 2. Alloy and temper recommended by window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 150 MPa (22,000 psi) ultimate tensile strength, and yield of 110 MPa (16,000 psi).
- B. Glazing Gaskets: ASTM C 509.

**2.1 SLIDING GLASS PASS WINDOW, COUNTER MOUNTED**

- A. Fabricate sliding glass sash and frames of extruded aluminum with corners mitered.
- B. Fabricate sash to receive 6 mm (1/4 inch) thick glass.
- C. Fabricate sliding sash of "H" channel molding at bottom edges including concealed nylon rollers at bottom set on track and guides at top set into track.

**SECTION 08 56 19  
PASS WINDOWS**

**2.1 SLIDING GLASS PASS WINDOWS, COUNTER MOUNTED (CONT)**

- D. Provide sash with pin tumbler lock and two keys.
- E. Provide sash with finger slot on vertical edge.
- F. Fabricate frame with channel sash slot, bottom roller track, and top guides.
- G. Sash may be factory or field glazed using glazing gaskets.
- H. Use concealed screws in assembly.
- I. Finish:
  - 1. Clear anodic coating, Class II Architectural 0.4 mills thick, AA-C22A41.
- J. Extent of Work: Ward Clerk

**2.1 GLASS PASS WINDOW, COUNTER MOUNTED**

- A. Fabricate glass sash and frames of extruded aluminum with corners mitered.
- B. Fabricate sash to receive 6 mm (1/4 inch) thick glass.
- C. Sill to accommodate metal shelf and deal tray for pass thru.
- D. Provide interlock on package transfer doors so both doors cannot be opened at the same time.
- E. Fixed glass with speaker portal
- F. Sash may be factory or field glazed using glazing gaskets.
- G. Use concealed screws in assembly.
- H. Finish:
  - 1. Clear anodic coating, Class II Architectural 0.4 mills thick, AA-C22A41.
- I. Extent of Work: Pharmacy

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install in pass window opening level and plumb.
- B. Secure with screws to opening; ASME B18.6.4.
  - 1. Screw within 100 mm (4 inches) of ends.
  - 2. Space screws not over 600 mm (24 inches) between end screws.
- D. Clean unit of dust and markings.

**3.2 OPERATION**

- A. Adjust to roll smoothly and stay in position where stopped.
- B. Demonstrate to Resident Engineer operation and locking.
- C. Turn keys with key tags over to Resident Engineers.

-- E N D --



**SECTION 08 63 00  
METAL-FRAMED SKYLIGHTS**

**PART 1 – GENERAL**

**1.1 DESCRIPTION:**

Section specifies field erected aluminum framed skylights.

**1.2 RELATED WORK:**

- A. Field installed joint sealants in connection with metal framed skylights: Section 07 92 00, JOINT SEALANTS.
- B. Glazing: Section 08 80 00, GLAZING.
- C. Finish Color: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 QUALITY ASSURANCE:**

- A. Qualifications:
  - 1. Approval is required of products or service of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
    - a. Manufacturers Qualifications: Manufacturer with five years continuous documented experience in design, fabrication and installation of metal framed skylights of type and size required for that project.
    - d. Testing Agency Qualifications: ISO 9000 Refer to Performance Requirements and Field Quality Control articles for testing requirements.
    - e. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of metal-framed skylights. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, one another, and adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance:
      - 1) Do not modify intended aesthetic effects. If modifications are proposed, submit comprehensive explanatory data for review.
    - f. Welding: Welding shall be performed by certified welders qualified in accordance with AWS D1.2, using procedures, materials and equipment of the type required for this work.
- B. Pre-Installation Conference:
  - 1. Prior to starting installation of skylight system schedule conference with Contracting Officer to ensure (1) a clear understanding of drawings and specifications; (2) onsite inspection and acceptance of structural and pertinent structural details relating to skylight system; and (3) coordination of work of various trades involved in providing related work. Conference shall be attended by Contractor; personnel directly responsible for installation of skylight system, flashing and sheet metal work and skylight manufacturer. Conflicts shall be resolved and confirmed in writing.

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**1.4 SUBMITTALS:**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Product Data:
  - 1. Manufacturers standard details and fabrication methods.
  - 2. Data on finishing, components, and accessories.
  - 3. Instructions: Submit detail specifications and instructions for installation, and adjustments.
  - 4. Recommendations for maintenance and cleaning of exterior surfaces.
- C. Shop Drawings: Show elevations of skylights at 1:50 (1/4 inch) scale, metal gages, details of construction, methods of anchorage, glazing details, and details of installation.
- D. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.5 DELIVERY, STORAGE, AND HANDLING:**

- A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.
- B. Inspect materials delivered to site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Stack materials on non-absorptive strips or wood platforms. Do not cover frames with tarps, polyethylene film, or similar coverings. Protect finished surfaces during shipping and handling using manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which caulking and glazing compounds must adhere.

**1.6 PROJECT CONDITIONS:**

Field Measurements: Where metal-framed skylights are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.

**1.7 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
  - 501-05..... Methods of Test for Exterior Walls
  - 503-08..... Field Testing of Metal Storefronts, Curtain walls and Sloped Glazing Systems

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**1.7 APPLICABLE PUBLICATIONS: (CONT)**

- 2605-11..... Superior Performing Organic Coatings on Architectural Aluminum Extrusions and Panels
- C. American Society for Testing and Materials (ASTM):
- A36/ A36M-08 ..... Carbon Structural Steel
- B209-07 ..... Aluminum and Aluminum-Alloy Sheet and Plate
- B211/ B211M-03..... Aluminum-Alloy Bar, Rod and Wire
- B221/ B221M-08..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- B316/ B316M-10..... Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods
- C864-05..... Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers
- C920-11..... Elastomeric Joint Sealants
- E330-02(R2010)..... Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference
- E331-00(R2009)..... Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
- E1105-00(R2008)..... Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Differences
- D. American Welding Society (AWS):
- D1.2/ D1.2M-08 ..... Structural Welding Code-Aluminum
- F. National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500-06 ..... Metal Finishes Manual

**1.9 WARRANTY**

Warranty metal skylight against leaks, and structural failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to 5 years.

**PART 2 - PRODUCTS**

**2.1 SYSTEM DESCRIPTION:**

- A. Design Requirements:
1. System shall meet or exceed all performance requirements specified.
  2. Extruded aluminum members with a system of alternate serrations for attachment of exterior caps and glass supports.
  3. Integral guttering system within skylight framing members for positive drainage of condensation. Integral weeping system to drain to exterior.
  4. Flush glazed exterior joints as indicated on contract drawings.
  5. All structural silicone shall be factory applied.
  6. Glazing Requirement: Refer to Section 08 80 00, GLAZING for glazing requirements.

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**2.1 SYSTEM DESCRIPTION: (CONT)**

- B. Manufacturers Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of skylights that are similar to those indicated for this Project in material, design, and extent.
- C. Performance Requirements:
  - 1. Structural Members: Of sizes to support design loads as indicated on structural Contract Drawings and as outlined below.
  - 2. Deflection of framing member in a direction normal to plane of glass when subjected to a uniform load deflection test in accordance with ASTM E330, Procedure B, and per above specified structural design loads as indicated on structural contract drawings, shall not exceed 1/175 nor 25 mm (1 inch) of its clear span for clear spans less than 6000 mm (20 feet) or 1/240 of clear spans greater than 6000 mm (20 feet).
  - 3. Air Infiltration: When tested in accordance with ASTM E283, shall not exceed 0.03 L/S per sqm (0.06 cfm per square foot) of fixed skylight surface.
  - 4. Water Penetration: No water shall penetrate when skylight is tested in accordance with ASTM E331 at a differential static pressure of 20 percent of inward acting design wind pressure, with a minimum of 300Pa (6.24 psf)

**2.2 MATERIALS:**

- A. Framework:
  - 1. Principle Supporting Members: 3 mm (0.125 inch) minimum thickness extruded aluminum, alloy 6063-T5, 6063-T6, or 6061-T6 per ASTM B221M. Profiles as indicated on Contract Drawings.
  - 2. Snap-on Covers and Miscellaneous Non-supporting Trim: 1.5 mm (0.062 inch) minimum thickness extruded aluminum, alloy 6063-T5 per ASTM B221M.
  - 3. Principle Formed Metal Members: 3 mm (0.125 inch) minimum thickness aluminum, alloy 5052, 5005, or 6061-T6 per ASTM B209M.
  - 4. Internal Reinforcement: ASTM A36M, steel shapes as required for strength and mullion size limitations, hot-dip galvanized after fabrication in accordance with ASTM A123.
- B. Glazing Strips: ASTM C864:
  - 1. Glass and glazing material as specified in Section 08 80 00, GLAZING.
    - a. Tempered and obscured
  - 2. Extruded EDPM rubber designed to comply with the following specifications:
    - a. Hardness: 55+/-5 Durometer.
    - b. Tensile Strength: 12410 kPa (1800 psi) minimum.
    - c. Elongation: 500 percent minimum.
    - d. Color: Black
  - 3. Heat Aging Characteristics:
    - a. 70 hours at 100 degrees C (212 degrees F).
    - b. Hardness Change: +5 Durometer.
    - c. Tensile Change: -10 percent
    - d. Elongation Change: -20 percent

**SECTION 08 63 00  
METAL-FRAMED SKYLIGHTS**

**2.2 MATERIALS: (CONT)**

4. Weather resistance at 1 part ozone per million, 500 hours at 20% elongation: No cracks.
5. No visual checks, cracks or breaks after completion of tests.
- C. Setting Blocks:
  1. Extruded Type II silicone rubber designed to permit adhesion and comply with the following specifications; comply with ASTM C864:
    - a. Hardness: 80+/- Durometer
    - b. Color: Black
- D. Fasteners:
  1. For Exterior Cap Retainers: ASTM A193 B8 300 series stainless steel screws.
  2. For Framework Connections: ASTM B211M 2024-T4 aluminum, ASTM A193 B8 300 series stainless steel, and ASTM B316 aluminum rivets, as required by connection.
  3. For Anchoring Skylight to Support Structure: ASTM A307 zinc plated steel fasteners.
- E. Flashings: Comply with Section 07 60 00, FLASHING AND SHEET METAL.
- F. Glass:
  1. Refer to requirements of Section 08 80 00, GLAZING.
  2. Glass Sizes and Clearances:
    - a. Accommodate up to 25 mm (1 inch) glazing.
    - b. Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip glass to remove flares or to reduce oversized dimensions. All cutting shall occur in factory.

**2.3 FABRICATION**

- A. Skylight components shall be of materials and thickness indicated or specified. Details indicated are representative of required design and profiles. Unless specifically indicated or specified otherwise, methods of fabrication and assembly shall be at discretion of manufacturer. Perform fitting and assembling of components in shop to maximum extent practicable. Anchorage devices shall permit adjustment in three directions. There shall be no exposed fasteners.
- C. Insofar as practicable, fit and assemble work in manufacturer's shop. Work that cannot be permanently assembled shall be shop-assembled, marked and disassembled before shipment to job site.
- D. Design rafter bars for snap-in type glazing strips.
- E. Attach snap-on cap retainers using stainless steel fasteners into a system of alternate serrations, at a maximum spacing of 300 mm (12 inches) on center.
- F. Design snap-on cap retainer fasteners to provide not more than 187 g/mm (10 pounds per linear inch) of compression on glazing strips and glass edge.
- G. Use snap-on type caps to conceal snap-on cap retainer fasteners.
- H. Where applicable, shop rivet or weld aluminum clips to framing members or field bolt at installation.
- I. Set glass with exterior EDPM glazing strips.
- J. Use silicone setting blocks to support glass and to provide edge clearances and glass bites as outlined below, in accordance with GANA recommendations:

**SECTION 08 63 00  
METAL-FRAMED SKYLIGHTS**

**2.3 FABRICATION (CONT)**

1. Set blocks not less than 150 mm (6 inches) from edge of glass for support of unit.
2. Glass Bite: Not less than 13 mm (1/2 inch) nor more than 16 mm (5/8 inch) on any side of glass unit.
3. Maintain 6 mm (1/4 inch) edge clearance between glass and adjacent metal framework.
4. Use rubber spacers to maintain separation of glass and adjacent metal framework.
- K. Locate weep holes in curb to positively drain condensation to exterior of skylight at each rafter connection.
- L. Dissimilar Metals: Separate dissimilar metals with bituminous paint or other separator that will prevent galvanic action.
- M. Fasteners: Conceal fasteners wherever possible. Countersink heads of exposed fasteners.

**2.4 METAL FINISHES:**

- A. As specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Fluorocarbon Finish: AAMA 2605:
  1. Color as selected.
- C. Sealants:
  1. Structural Flush Glazed Joints: High performance silicone sealant applied in accordance with manufacturer's recommendations.
  2. Non-structural Flush Glazed Joints and Weather Seal Joints: Silicone sealants applied in accordance with manufacturer's recommendations.
  3. Structural silicone shall not be used to support dead weight of vertical glass or panels.

**PART 3 - EXECUTION**

**3.1 EXAMINATION:**

Prior to installation of skylight system, arrange for representative(s) of skylight manufacturer to examine structure and substrate to determine that they are properly prepared, sized and ready to receive skylight work included herein.

**3.2 INSPECTION AND PREPARATION:**

Contact between aluminum and dissimilar metals shall receive a protective coating of asphaltic paint for prevention of electrolytic action and corrosion.

**3.3 INSTALLATION:**

- A. Install skylight frame, glass and accessory items as needed in accordance with manufacturer's instructions.
- B. Install skylight system by factory trained mechanics.
- C. Erect system plumb and true in proper alignment and relation to established lines and grades as shown on approved shop drawings.
- D. Anchor skylight to structure in strict accordance with approved Shop Drawings.
- E. Use high-performance silicone sealants to seal horizontal joints between glass panels and silicone sealant to wet seal joints between snap-on cap retainers and glass.

**SECTION 08 63 00**  
**METAL-FRAMED SKYLIGHTS**

**3.3 INSTALLATION: (CONT)**

- F. Apply sealing materials in strict accordance with sealant manufacturer's instructions. Before application, remove mortar dirt, dust, moisture and other foreign matter from surfaces it will contact. Mask adjoining surfaces to maintain a clean, neat appearance. Tool sealing compounds to fill joint and provide a smooth finish.

**3.4 TOLERANCES:**

- A. All parts of work, when completed, shall be within the following tolerances:
  - 1. Maximum variation from plane or location shown on approved shop drawings: 3 mm per 3600 mm (1/8 inch per 12 feet) of length, or 10 mm (3/8 inch) in total length.
  - 2. Maximum offset from true alignment between two members abutting end-to-end, edge-to-edge in line: .75 mm (1/32 inch).

**3.5 FIELD QUALITY CONTROL:**

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field quality-control tests and to prepare test reports.
- B. Water-Spray Test: Test skylights for compliance with requirements according to procedures in AAMA 501.
- C. Repair or replace Work that does not meet requirements or that is damaged by testing; repair or replace to comply with specifications.

**3.6 CLEANING:**

- A. Install skylight frame and associated metal to avoid soiling or smudging finish.
- B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Follow recommendations of skylight manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
- E. Clean glass just prior to time of final acceptance of building, subsequent to completion of installation.

**3.7 PROTECTION:**

Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

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**SECTION 08 71 00  
DOOR HARDWARE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Door hardware and related items necessary for complete installation and operation of doors.

**1.2 RELATED WORK**

- A. Caulking: Section 07 92 00 JOINT SEALANTS.  
B. Application of Hardware: Section 08 14 00, WOOD DOORS Section 08 11 13, HOLLOW METAL DOORS AND FRAMES Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS Section 08 33 00, COILING DOORS AND GRILLES Section 08 71 13, AUTOMATIC DOOR OPERATORS Section 08 71 13.11, LOW ENERGY DOOR OPERATORS Section 32 31 33, CHAIN LINK FENCES AND GATES  
C. Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.  
D. Electrical: Division 26, ELECTRICAL.  
E. Fire Detection: Section 28 31 00, FIRE DETECTION AND ALARM.

**1.3 GENERAL**

- A. All hardware shall comply with UFAS, (Uniform Federal Accessible Standards) unless specified otherwise.  
B. Provide rated door hardware assemblies where required by most current version of the International Building Code (IBC).  
C. Hardware for Labeled Fire Doors and Exit Doors: Conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Provide hardware listed by UL, except where heavier materials, large size, or better grades are specified herein under paragraph HARDWARE SETS. In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements.  
D. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.  
E. The following items shall be of the same manufacturer, if possible, except as otherwise specified:  
1. Mortise locksets.  
2. Hinges for hollow metal and wood doors.  
3. Surface applied overhead door closers.  
4. Exit devices.  
5. Floor closers.

**1.4 WARRANTY**

- A. Automatic door operators shall be subject to the terms of FAR Clause 52.24-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:  
1. Locks, latchsets, and panic hardware: 5 years.  
2. Door closers and continuous hinges: 10 years.

**SECTION 08 71 00  
DOOR HARDWARE**

**1.5 MAINTENANCE MANUALS**

- A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on all door hardware.

**1.6 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23 plus 2 copies to the VAMC Locksmith (VISN Locksmith if the VAMC does not have a locksmith).
- B. Hardware Schedule: Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

**1.7 DELIVERY AND MARKING**

- A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to Resident Engineer for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in Resident Engineer's office until all other similar items have been installed in project, at which time the Resident Engineer will deliver items on file to Contractor for installation in predetermined locations on the project.

**1.8 PREINSTALLATION MEETING**

- A. Convene a preinstallation meeting not less than 30 days before start of installation of door hardware. Require attendance of parties directly affecting work of this section, including Contractor and Installer, Architect, Project Engineer and VA Locksmith, Review the following:
1. Inspection of door hardware.
  2. Job and surface readiness.
  3. Coordination with other work.
  4. Protection of hardware surfaces.
  5. Substrate surface protection.
  6. Installation.
  7. Adjusting.
  8. Repair.
  9. Field quality control.
  10. Cleaning.

**SECTION 08 71 00  
DOOR HARDWARE**

**1.9 INSTRUCTIONS**

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.
- B. Manufacturers' Catalog Number References: Where manufacturers' products are specified herein, products of other manufacturers which are considered equivalent to those specified may be used. Manufacturers whose products are specified are identified by abbreviations as follows:

Adams-Rite	Adams Rite Mfg. Co.	Pomona, CA
Best	Best Access Systems	Indianapolis, IN
Don-Jo	Don-Jo Manufacturing	Sterling, MA
G.E. Security	GE Security, Inc.	Bradentown, FL
Markar	Markar Architectural Products	Pomona, CA
Pemko	Pemko Manufacturing Co.	Ventura, CA
Rixson	Rixson	Franklin Park, IL
Rockwood	Rockwood Manufacturing Co.	Rockwood, PA
Securitron	Securitron Magnalock Corp.	Sparks, NV
Southern Folger	Southern Folger Detention Equipment Co.	San Antonio, TX
Stanley	The Stanley Works	New Britain, CT
Tice	Tice Industries	Portland, OR
Trimco	Triangle Brass Mfg. Co.	Los Angeles, CA
Zero	Zero Weather Stripping Co.	New York, NY

- C. Keying: A new Great Grandmaster key shall be established for this project. The key system shall be small format (Best size and profile) removable core type as previously described. The key blanks shall be protected by a utility patent with a minimum seven years remaining on the patent from the start of construction, and protected by contract-controlled distribution. The manufacturer shall furnish code pattern listings in both paper and electronic formats so keys may be reproduced by code.; provide electronic format in file type required by project's key control software. The manufacturer shall design the new key system with the capacity to rekey the existing system and also provide for 25 percent expansion capability beyond this requirement. Submit a keying chart for approval showing proposed keying layout and listing expansion capacity.
1. Keying information will be furnished to the Contractor by the Resident Engineer.
  2. Supply information regarding key control of cylinder locks to manufacturers of equipment having cylinder type locks. Notify Resident Engineer immediately when

**SECTION 08 71 00  
DOOR HARDWARE**

**1.9 INSTRUCTIONS (CONT)**

and to whom keys or keying information is supplied. Return all such keys to the Resident Engineer.

**1.10 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.
- B. American Society for Testing and Materials (ASTM):
  - E2180-07.....Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials
- C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
  - A156.1-06 ..... Butts and Hinges
  - A156.2-03 ..... Bored and Pre-assembled Locks and Latches
  - A156.3-08 ..... Exit Devices, Coordinators, and Auto Flush Bolts
  - A156.4-08 ..... Door Controls (Closers)
  - A156.5-01 ..... Auxiliary Locks and Associated Products
  - A156.6-05 ..... Architectural Door Trim
  - A156.8-05 ..... Door Controls-Overhead Stops and Holders
  - A156.12-05 ..... Interconnected Locks and Latches
  - A156.13-05 ..... Mortise Locks and Latches Series 1000
  - A156.14-07 ..... Sliding and Folding Door Hardware
  - A156.16-08 ..... Auxiliary Hardware
  - A156.17-04 ..... Self-Closing Hinges and Pivots
  - A156.18-06 ..... Materials and Finishes
  - A156.21-09 ..... Thresholds
  - A156.22-05 ..... Door Gasketing and Edge Seal Systems
  - A156.24-03 ..... Delayed Egress Locking Systems
  - A156.25-07 ..... Electrified Locking Devices
  - A156.26-06 ..... Continuous Hinges
  - A156.28-07 ..... Master Keying Systems
  - A156.29-07 ..... Exit Locks and Alarms
  - A156.30-03 ..... High Security Cylinders
  - A156.31-07 ..... Electric Strikes and Frame Mounted Actuators
  - A250.8-03 ..... Standard Steel Doors and Frames
- D. National Fire Protection Association (NFPA):
  - 80-10 ..... Fire Doors and Fire Windows
  - 101-09 ..... Life Safety Code
- E. Underwriters Laboratories, Inc. (UL):
  - Building Materials Directory (2008)

**SECTION 08 71 00  
DOOR HARDWARE**

**PART 2 - PRODUCTS**

**2.1 BUTT HINGES**

- A. ANSI A156.1. Provide only three-knuckle hinges, except five-knuckle where the required hinge type is not available in a three-knuckle version (e.g., some types of swing-clear hinges). The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:
  - 1. Exterior Doors: Type A2112/ A5112 for doors 900 mm (3 feet) wide or less and Type A2111/ A5111 for doors over 900 mm (3 feet) wide. Hinges for exterior outswing doors shall have non-removable pins. Hinges for exterior fire-rated doors shall be of stainless steel material.
  - 2. Interior Doors: Type A8112/ A5112 for doors 900 mm (3 feet) wide or less and Type A8111/ A5111 for doors over 900 mm (3 feet) wide. Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc. shall be of stainless steel material.
- B. Provide quantity and size of hinges per door leaf as follows:
  - 1. Doors up to 1210 mm (4 feet) high: 2 hinges.
  - 2. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.
  - 3. Doors greater than 2260 mm (7 feet 5 inches) high: 4 hinges.
  - 4. Doors up to 900 mm (3 feet) wide, standard weight: 114 mm x 114 mm (4-1/2 inches x 4-1/2 inches) hinges.
  - 5. Doors over 900 mm (3 feet) to 1065 mm (3 feet 6 inches) wide, standard weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
  - 6. Doors over 1065 mm (3 feet 6 inches) to 1210 mm (4 feet), heavy weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
  - 7. Provide heavy-weight hinges where specified.
  - 8. At doors weighing 330 kg (150 lbs.) or more, furnish 127 mm (5 inch) high hinges.
- C. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above and continuous hinges specified below.

**2.2 CONTINUOUS HINGES**

- A. ANSI/BHMA A156.26, Grade 1-600.
  - 1. Listed under Category N in BHMA's "Certified Product Directory."
- B. General: Minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete
- C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a Teflon-coated 6.35mm (0.25-inch) minimum diameter pin that extends entire length of hinge.
  - 1. Base Metal for Exterior Hinges: Stainless steel.
  - 2. Base Metal for Interior Hinges: Steel
  - 3. Base Metal for Hinges for Fire-Rated Assemblies: Steel
  - 4. Provide with non-removable pin (hospital tip option) at lockable outswing doors.
  - 5. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.
  - 6. Provide with manufacturer's cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.

**SECTION 08 71 00  
DOOR HARDWARE**

**2.2 CONTINUOUS HINGES (CONT)**

7. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.
8. Where models are specified that provide an integral wrap-around edge guard for the hinge edge of the door, provide manufacturer's adjustable threaded stud and machine screw mechanism to allow the door to be adjusted within the wrap-around edge guard.

**2.3 DOOR CLOSING DEVICES**

- A. Closing devices shall be products of one manufacturer for each type specified.

**2.4 OVERHEAD CLOSERS**

- A. Conform to ANSI A156.4, Grade 1.
- B. Closers shall conform to the following:
1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
  2. Where specified, closer shall have hold-open feature.
  3. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
  4. Material of closer body shall be forged or cast.
  5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.
  6. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.
  7. Closers shall have full size metal cover; plastic covers will not be accepted.
  8. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.
  9. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
  10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
  11. Provide parallel arm closers with heavy duty rigid arm.
  12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
  13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.
  14. All closers shall have a 1 1/2" (38mm) minimum piston diameter.

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DOOR HARDWARE**

**2.6 DOOR STOPS**

- A. Conform to ANSI A156.16.
- B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.
- C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
- D. Provide floor stops (Type L02141 or L02161 in office areas; Type L02121 x 3 screws into floor elsewhere. Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its width. Floor stops, where used, must be installed within 4-inches of the wall face and impact the door within the leading half of its width.
- E. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.
- F. Provide stop Type L02011, as applicable for exterior doors. At out swing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled hole and filled with quick-setting cement.
- G. Omit stops where floor mounted door holders are required and where automatic operated doors occur.
- H. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.
- I. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.
- J. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.
- K. Provide door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4-inches of the wall.
- L. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

**2.7 OVERHEAD DOOR STOPS AND HOLDERS**

- A. Conform to ANSI Standard A156.8. Overhead holders shall be of sizes recommended by holder manufacturer for each width of door. Set overhead holders for 110 degree opening, unless limited by building construction or equipment. Provide Grade 1 overhead concealed slide type: stop-only at rated doors and security doors, hold-open type with exposed hold-open on/off control at all other doors requiring overhead door stops.

**2.8 LOCKS AND LATCHES**

- A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than seven pins. Cylinders for all locksets shall be removable core type. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or

**SECTION 08 71 00  
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**2.8 LOCKS AND LATCHES (CONT)**

lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer's fire label. Provide temporary keying device or construction core of allow opening and closing during construction and prior to the installation of final cores.

- B. In addition to above requirements, locks and latches shall comply with following requirements:
1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be series 1000, minimum Grade 2. All locksets and latchsets, except on designated doors in Psychiatric (Mental Health) areas, shall have lever handles fabricated from cast stainless steel. Provide sectional (lever x rose) lever design matching [\_\_\_\_\_]. No substitute lever material shall be accepted. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Lock function F02 shall be furnished with emergency tools/keys for emergency entrance. All lock cases installed on lead lined doors shall be lead lined before applying final hardware finish. Furnish armored fronts for all mortise locks. Where mortise locks are installed in high-humidity locations or where exposed to the exterior on both sides of the opening, provide non-ferrous mortise lock case.
  2. Cylindrical Lock and Latch Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be series 4000 Grade I. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Provide lever design to match design selected by Architect or to match existing lever design. Where two turn pieces are specified for lock F76, turn piece on inside knob shall lock and unlock inside knob, and turn piece on outside knob shall unlock outside knob when inside knob is in the locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)
  3. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.5.
  4. Locks on designated doors in Psychiatric (Mental Health) areas shall be paddle type with arrow projection covers and be UL Listed. Provide these locks with paddle in the down position on both sides of the door. Locks shall be fabricated of wrought stainless steel.
  5. Privacy locks in non-mental-health patient rooms shall have an inside thumbturn for privacy and an outside thumbturn for emergency entrance. Single occupancy patient privacy doors shall typically swing out; where such doors cannot swing out, provide center-pivoted doors with rescue hardware (see HW-2B).

**2.10 PUSH-BUTTON COMBINATION LOCKS**

- A. ANSI/BHMA A156.13, Grade 1. Battery operated pushbutton entry.



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- B. Construction: Heavy duty mortise lock housing conforming to ANSI/BHMA A156.13, Grade 1. Lever handles and operating components in compliance with the UFAS and the ADA Accessibility Guidelines. Match lever handles of locks and latchsets on adjacent doors.
- C. Special Features: Key override to permit a master keyed security system and a pushbutton security code activated passage feature to allow access without using the entry code.

**2.12 ELECTRIC STRIKES**

- A. ANSI/ BHMA A156.31 Grade 1.
- B. General: Use fail-secure electric strikes at fire-rated doors.

**2.13 KEYS**

- A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

<b>Locks/Keys</b>	<b>Quantity</b>
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

- B. Psychiatric keys shall be cut so that first two bittings closest to the key shoulder are shallow to provide greater strength at point of greatest torque.

**2.16 EXIT DEVICES**

- A. Conform to ANSI Standard A156.3. Exit devices shall be Grade 1; type and function are specified in hardware sets. Provide flush with finished floor strikes for vertical rod exit devices in interior of building. Trim shall have cast satin stainless steel lever handles of design similar to locksets, unless otherwise specified. Provide key cylinders for keyed operating trim and, where specified, cylinder dogging.
- B. Surface vertical rod panics shall only be provided less bottom rod; provide fire pins as required by exit device and door fire labels. Do not provide surface vertical rod panics at exterior doors.
- C. Concealed vertical rod panics shall be provided less bottom rod at interior doors, unless lockable or otherwise specified; provide fire pins as required by exit device and door fire labels. Where concealed vertical rod panics are specified at exterior doors, provide with both top and bottom rods.

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**2.16 EXIT DEVICES (CONT)**

- D. Where removable mullions are specified at pairs with rim panic devices, provide mullion with key-removable feature.
- E. At non-rated openings with panic hardware, provide panic hardware with key cylinder dogging feature.
- F. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.

**2.17 FLUSH BOLTS (LEVER EXTENSION)**

- A. Conform to ANSI A156.16. Flush bolts shall be Type L24081 unless otherwise specified. Furnish proper dustproof strikes conforming to ANSI A156.16, for flush bolts required on lower part of doors.
- B. Lever extension manual flush bolts shall only be used at non-fire-rated pairs for rooms only accessed by maintenance personnel.
- C. Face plates for cylindrical strikes shall be rectangular and not less than 25 mm by 63 mm (1 inch by 2-1/2 inches).
- D. Friction-fit cylindrical dustproof strikes with circular face plate may be used only where metal thresholds occur.
- E. Provide extension rods for top bolt where door height exceeds 2184 mm (7 feet 2 inches).

**2.18 FLUSH BOLTS (AUTOMATIC)**

- A. Conform to ANSI A156.3. Dimension of flush bolts shall conform to ANSI A115. Bolts shall conform to Underwriters Laboratories, Inc., requirements for fire door hardware. Flush bolts shall automatically latch and unlatch. Furnish dustproof strikes conforming to ANSI A156.16 for bottom flushbolt. Face plates for dustproof strike shall be rectangular and not less than 38 mm by 90 mm (1-1/2 by 3-1/2 inches).
- B. At interior doors, provide auto flush bolts less bottom bolt, unless otherwise specified, except at wood pairs with fire-rating greater than 20 minutes; provide fire pins as required by auto flush bolt and door fire labels.

**2.19 DOOR PULLS**

- A. Conform to ANSI A156.6. Pull plate 90 mm by 350 mm (3-1/2 inches by 14 inches), unless otherwise specified. Cut plates of door pulls for cylinders, or turn pieces where required.

**2.20 PUSH PLATES**

- A. Conform to ANSI A156.6. Metal, Type J302, 200 mm (8 inches) wide by 350 mm (14 inches) high. Provide metal Type J300 plates 100 mm (4 inches wide by 350 mm (14 inches) high) where push plates are specified for doors with stiles less than 200 mm (8 inches) wide. Cut plates for cylinders, and turn pieces where required.

**2.21 COMBINATION PUSH AND PULL PLATES**

- A. Conform to ANSI 156.6. Type J303, stainless steel 3 mm (1/8 inch) thick, 80 mm (3-1/3 inches) wide by 800 mm (16 inches) high), top and bottom edges shall be rounded. Secure

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plates to wood doors with 38 mm (1-1/2 inch) long No. 12 wood screws. Cut plates for turn pieces, and cylinders where required. Pull shall be mounted down.

**2.22 COORDINATORS**

- A. Conform to ANSI A156.16. Coordinators, when specified for fire doors, shall comply with Underwriters Laboratories, Inc., requirements for fire door hardware. Coordinator may be omitted on exterior pairs of doors where either door will close independently regardless of the position of the other door. Coordinator may be omitted on interior pairs of non-labeled open where open back strike is used. Open back strike shall not be used on labeled doors. Paint coordinators to match door frames, unless coordinators are plated. Provide bar type coordinators, except where gravity coordinators are required at acoustic pairs. For bar type coordinators, provide filler bars for full width and, as required, brackets for push-side surface mounted closers, overhead stops, and vertical rod panic strikes.

**2.23 THRESHOLDS**

- A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with 1/4-20 stainless steel machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.
- B. For thresholds at elevators entrances see other sections of specifications.
- C. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.
- D. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) from frame face.

**2.24 AUTOMATIC DOOR BOTTOM SEAL AND RUBBER GASKET FOR LIGHT PROOF OR SOUND CONTROL DOORS**

- A. Conform to ANSI A156.22. Provide mortise or under-door type, except where not practical. For mortise automatic door bottoms, provide type specific for door construction (wood or metal).

**2.25 WEATHERSTRIPS (FOR EXTERIOR DOORS)**

- A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length (0.000774m<sup>3</sup>/s/m).

**2.26 MISCELLANEOUS HARDWARE**

- A. Access Doors (including Sheet Metal, Screen and Woven Wire Mesh Types): Except for fire-rated doors and doors to Temperature Control Cabinets, equip each single or double metal access door with Lock Type E76213, conforming to ANSI A156.5. Key locks as directed. Ship lock prepaid to the door manufacturer. Hinges shall be provided by door manufacturer.

**2.26 MISCELLANEOUS HARDWARE (CONT)**

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- B. Cylinders for Various Partitions and Doors: Key cylinders same as entrance doors of area in which partitions and door occur, // except as otherwise specified //. Provide cylinders to operate locking devices where specified for following partitions and doors:
  - 1. Folding doors and partitions.
  - 2. Wicket door (in roll-up door assemblies).
  - 3. Slide-up doors.
  - 4. Swing-up doors.
  - 5. Fire-rated access doors-Engineer's key set.
  - 6. Doors from corridor to electromagnetic shielded room.
  - 7. Day gate on vault door.
- C. Mutes: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011 or L03021, depending on frame material, of white or light gray color, on each steel or wood door frame, except at fire-rated frames, lead-lined frames and frames for sound-resistant, lightproof and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or silencers for frames for each Dutch type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

**2.27 PADLOCKS FOR VARIOUS DOORS, GATES AND HATCHES**

- A. ASTM E883, size 50 mm (2 inch) wide chain; furnish extended shackles as required by job conditions. Provide padlocks, with key cylinders, for each door in following areas as noted.
- B. Key padlocks as follows:
  - 1. Chain Link Fence Gates for Electrical Substation and other Fenced Buildings or Areas: Engineer's set, except as otherwise specified.
  - 2. Chain Link Fence Gates for Oxygen Storage Buildings: Maintenance supply set.
  - 3. Roof Access and Scuttles: Engineer's set.

**2.28 HINGED WIRE GUARDS (FOR WINDOWS, DOORS AND TRANSOMS) AND WIRE PARTITION DOORS**

- A. Butt hinges, type A8133 (special swaging) 100 mm by 90 mm (4 inches by 3-1/2 inches), Finish US2C.
  - 1. 3 hinges for guards over 1060 mm (3-1/2 feet) high.
  - 2. 2 hinges for guards less than 1060 mm (3-1/2 feet) high.
- B. Conform to ANSI A156.5. Lock Type E06081 for guards and Type E06061 for partitions.
  - 1. Keying: Except as noted otherwise, key locks like entrance door or space wherein guards and partitions are located except as otherwise specified.
  - 2. Key locks for partitions enclosing mechanical and electrical equipment in Engineer's Set. (See detailed drawings for number of locks and butt hinges required for each guard).

**2.30 FINISHES**

- A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.
- B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.

**SECTION 08 71 00  
DOOR HARDWARE**

**2.30 FINISHES (CONT)**

- C. Miscellaneous Finishes:
1. Hinges --exterior doors: 626 or 630.
  2. Hinges --interior doors: 652 or 630.
  3. Pivots: Match door trim.
  4. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.
  5. Thresholds: Mill finish aluminum.
  6. Cover plates for floor hinges and pivots: 630.
  7. Other primed steel hardware: 600.
- E. Special Finish: Exposed surfaces of hardware for dark bronze anodized aluminum doors shall have oxidized oil rubbed bronze finish (dark bronze) finish on door closers shall closely match doors.

**2.31 BASE METALS**

- A. Apply specified U.S. Standard finishes on different base metals as following:

<b>Finish</b>	<b>Base Metal</b>
652	Steel
626	Brass or bronze
630	Stainless steel

**PART 3 - EXECUTION**

**3.1 HARDWARE HEIGHTS**

- A. For new buildings locate hardware on doors at heights specified below, with all hand-operated hardware centered within 864 mm (34 inches) to 1200 mm (48 inches), unless otherwise noted:
- B. Hardware Heights from Finished Floor:
1. Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
  2. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
  3. Deadlocks centerline of strike 1219 mm (48 inches).
  5. Centerline of door pulls to be 1016 mm (40 inches).
  6. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
  7. Push-pull latch to be 1024 mm (40-5/16 inches) to centerline of strike.
  8. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

**3.2 INSTALLATION**

- A. Closer devices, including those with hold-open features, shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment. Closers shall be mounted on side of door inside rooms, inside stairs, and away from corridors except security bedroom, bathroom and anteroom doors which shall have closer installed parallel arm on exterior side of doors

**SECTION 08 71 00  
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**3.2 INSTALLATION (CONT)**

At exterior doors, closers shall be mounted on interior side. Where closers are mounted on doors they shall be mounted with sex nuts and bolts; foot shall be fastened to frame with machine screws.

**B. Hinge Size Requirements:**

<b>Door Thickness</b>	<b>Door Width</b>	<b>Hinge Height</b>
45 mm (1-3/4 inch)	900 mm (3 feet) and less	113 mm (4-1/2 inches)
45 mm (1-3/4 inch)	Over 900 mm (3 feet) but not more than 1200 mm (4 feet)	125 mm (5 inches)
35 mm (1-3/8 inch) (hollow core wood doors)	Not over 1200 mm (4 feet)	113 mm (4-1/2 inches)

C. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.

**E. Hinges Required Per Door:**

Doors 1500 mm (5 ft) or less in height	2 butts
Doors over 1500 mm (5 ft) high and not over 2280 mm (7 ft 6 in) high	3 butts
Doors over 2280 mm (7 feet 6 inches) high	4 butts
Dutch type doors	4 butts
Doors with spring hinges 1370 mm (4 feet 6 inches) high or less	2 butts
Doors with spring hinges over 1370 mm (4 feet 6 inches)	3 butts

F. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather shall be of nonferrous metal.

G. After locks have been installed; show in presence of Resident Engineer that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the Resident Engineer for his records.) Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

**3.3 FINAL INSPECTION**

A. Installer to provide letter to VA Resident/Project Engineer that upon completion, installer has visited the Project and has accomplished the following:

1. Re-adjust hardware.

**SECTION 08 71 00  
DOOR HARDWARE**

**3.3 FINAL INSPECTION (CONT)**

2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
3. Identify items that have deteriorated or failed.
4. Submit written report identifying problems.

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**3.4 DEMONSTRATION**

- A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of Resident/Project Engineer and VA Locksmith.

**3.5 HARDWARE SETS**

- A. Following sets of hardware correspond to hardware symbols shown on drawings. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.

ELECTRIC HARDWARE ABBREVIATIONS LEGEND:

ADO = Automatic Door Operator

EMCH = Electro-Mechanical Closer-Holder

MHO = Magnetic Hold-Open (wall- or floor-mounted)

--- E N D ---





**SECTION 08 71 13**  
**AUTOMATIC DOOR OPERATORS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies equipment, controls and accessories for automatic operation of swing and sliding doors.

**1.2 RELATED WORK**

- A. Aluminum frames entrance work; Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- B. Door hardware; Section 08 71 00, DOOR HARDWARE.
- C. Electric general wiring, connections and equipment requirements; Division 26, ELECTRICAL.

**1.3 QUALITY ASSURANCE**

- A. Automatic door operators, controls and other equipment shall be products of a manufacturer regularly engaged in manufacturing such equipment for a minimum of three years.
- B. One type of automatic door equipment shall be used throughout the building.
- C. Equipment installer shall have specialized experience and shall be approved by the manufacturer.

**1.4 WARRANTY**

- A. Automatic door operators shall be subject to the terms of the "Warranty of Construction" Article of Section 00 72 00, GENERAL CONDITIONS, except that the Warranty period shall be two years in lieu of one year.

**1.5 MAINTENANCE MANUALS**

- A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on automatic door operators.

**1.6 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's literature and data describing operators, power units, controls, door hardware and safety devices.
- C. Shop Drawings:
  - 1. Showing location of controls and safety devices in relationship to each automatically operated door.
  - 2. Showing layout, profiles, product components, including anchorage, accessories, as applicable.
  - 3. Submit templates, wiring diagrams, fabrication details and other information to coordinate the proper installation of the automatic door operators.

**SECTION 08 71 13**  
**AUTOMATIC DOOR OPERATORS**

**1.7 DESIGN CRITERIA**

- A. As a minimum automatic door equipment shall comply with the requirements of BHMA 156.10. Except as otherwise noted on drawings, provide operators which will move the doors from the fully closed to fully opened position in five seconds maximum time interval, when speed adjustment is at maximum setting.
- B. Equipment: Conforming to UL 325. Provide key operated power disconnect wall switch for each door installation.
- C. Electrical Wiring, Connections and Equipment: Provide all motor, starter, controls, associated devices, and interconnecting wiring required for the installation. Equipment and wiring shall be as specified in Division 26, ELECTRICAL.

**1.8 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Builders Hardware Manufacturers Association, Inc. (BHMA):  
A156.10-05 ..... Power Operated Pedestrian Doors (BHMA 1601)
- C. National Fire Protection Association (NFPA):  
101-09 ..... Life Safety Code
- D. Underwriters Laboratory (UL):  
325-10 ..... Door, Drapery, Gate, Louver, and Window Operators and Systems

**1.9 DELIVERY AND STORAGE**

- A. Delivery shall be in factory's original, unopened, undamaged container with identification labels attached.

**PART 2 - PRODUCTS**

**2.1 SWING DOOR OPERATORS**

- A. General: Swing door operators shall be of institutional type, door panel size 600 mm to 1250 mm (2'-0" to 5'-0") width, weight not to exceed 300 kg (600 pounds), electric operated for overhead mounting within the header or transom. Furnish metal mounting supports, brackets and other accessories necessary for the installation of operators at the head of the door frames. The motor on automatic door operator shall be provided with an interlock so that the motor will not operate when doors are electrically locked from opening.
- B. Operators shall have checking mechanism providing cushioning action at last part of door travel, in both opening and closing cycle. Operators shall be capable of recycling doors instantaneously to full open position from any point in the closing cycle when control switch is activated. Operators shall, when automatic power is interrupted or shut-off, permit doors to easily open manually without damage to automatic operator system.
- C. Operator, enclosed in housing, shall open door by energizing motor and shall stop by electrically reducing voltage and stalling motor against mechanical stop. Door shall close by means of spring energy, and close force shall be controlled by gear system and motor being used as dynamic break without power, or controlled by hydraulic closer in electro-hydraulic operators. System shall operate as manual door control in event of power failure. Opening and closing speeds shall be adjustable:

**SECTION 08 71 13**  
**AUTOMATIC DOOR OPERATORS**

**2.1 SWING DOOR OPERATORS (CONT)**

1. Operator Housing: Housing shall be a minimum of 112 mm (4-1/2 inches) wide by 140 mm (5.5 inches) high aluminum extrusions with enclosed end caps for application to 100 mm (4 inches) and larger frame systems. All structural sections shall have a minimum thickness of 3.2 mm (0.125 inch) and be fabricated of a minimum of 6063-T5 aluminum alloy.
2. Power Operator: Completely assembled and sealed unit which shall include gear drive transmission, mechanical spring and bearings, all located in aluminum case and filled with special lubricant for extreme temperature conditions. Complete unit shall be rubber mounted with provisions for easy maintenance and replacement, without removing door from pivots or frame.
3. Connecting hardware shall have drive arm attached to door with a pin linkage rotating in a self-lubricating bearing. Door shall not pivot on shaft of operator.
4. Electrical Control: Operator shall have a self contained electrical control unit, including necessary transformers, relays, rectifiers, and other electronic components for proper operation and switching of power operator. All connecting harnesses shall have interlocking plugs.

**2.2 MICROPROCESSOR CONTROLS**

- A. The system shall include a multi-function microprocessor control providing adjustable hold open time (1-30 seconds), LED indications for sensor input signals and operator status and power assist close options. Control shall be capable of receiving activation signals from any device with normally open dry contact output. All activation modes shall provide fully adjustable opening speed:
- B. The door shall be held open by low voltage applied to the continuous duty motor. The control shall include an adjustable safety circuit that monitors door operation and stops the opening direction of the door if an obstruction is sensed. The motor shall include a recycle feature that reopens the door if an obstruction is sensed at any point during the closing cycle. The control shall include a standard three position key switch with functions for ON, OFF, and HOLD OPEN, mounted on operator enclosure, door frame, or wall, as indicated in the architectural drawings.

**2.3 SLIDING DOOR OPERATORS**

- A. General: Sliding doors shall have electric operators, conforming to BHMA A156.10 and the following requirements as applicable. Assembly shall be single sliding doors as shown on drawings.
- B. Door Operation: Doors shall be opened by electric motor pulling door from closed to open position and shall stop door by electrically reducing voltage and stalling door against mechanical stop. System shall permit manual control of door in event of power failure. Opening and closing speeds shall be adjustable.
  1. In compliance with NFPA-101, door panels shall allow "breakout" to the full open position to provide instant egress at any point in the door's movement.
  2. One door system in Sally Port, a non-exit, shall not have a break away for security. See Drawings and hardware Schedule for location.
- C. Operators: Completely assembled and sealed electromechanical operating unit, all located in cast aluminum housing and filled with special lubricant for extreme conditions. Attached to

**SECTION 08 71 13**  
**AUTOMATIC DOOR OPERATORS**

**2.3 SLIDING DOOR OPERATORS (CONT)**

transmission system shall be a minimum 1/8 Hp "DC" shunt-wound permanent magnet motor with sealed ball bearings. Complete unit shall be rubber mounted with provisions for easy maintenance and replacement. Operators shall have adjustable opening and closing cycle. Housing shall be minimum 6063T-5 alloy aluminum not less than .005 mm (125 inch) minimum thickness, 150 mm by 200 mm (6 inch wide by 8 inch high).

- D. Sliding Door Hardware Guide Rollers, Door Carrier: Top door carriers shall ride on steel or delrin rollers incorporating sealed bearings with each door having two support rollers and one anti-rise roller. Each roller shall have a minimum of 9 mm (3/8-inch) of vertical adjustment with positive mechanical locks. Each door shall also include two urethane covered oil impregnated bearing bottom rollers attached with 5 mm (3/16-inch) thick formed steel guide brackets. Each door carrier supporting a door leaf shall include a vertical steel reinforcing member to prevent sagging when door is swung under breakaway conditions. All carbon steel brackets and fittings shall be plated for corrosion resistance.
- E. Locking Hardware: Do not provide any locking hardware at interior doors not requiring physical security. Provide doors with flush concealed vertical rod panic hardware integrated into the doors where physical security is required and free egress is required at all times. Provide doors with manufacturers' standard hookbolt lock (keyed both sides) where physical security is required and free egress is not required at all times. At doors with access control devices (card readers, etc.), provide doors with electronic deadbolt locking to prevent the doors from manually sliding open.
- F. Door Closers: Provide breakout or swing-out panels with door closers concealed in the top rail of the door.

**2.4 POWER UNITS**

Each power unit shall be self-contained, electric operated and independent of the door operator. Capacity and size of power circuits shall be in accordance with automatic door operator manufacturer's specifications and Division 26 - ELECTRICAL.

**2.5 DOOR CONTROLS**

- A. Opening and closing actions of doors shall be actuated by controls and safety devices specified, and conform to ANSI 156.10. Controls shall cause doors to open instantly when control device is actuated; hold doors in open positions; then, cause doors to close, unless safety device or reactivated control interrupts operation.
- B. Manual Controls:
  - 1. Push Plate Wall Switch: Recess type, stainless steel push plate minimum 100 mm by 100 mm (four-inch by four-inch), with 13 mm (1/2-inch) high letters "To Operate Door--Push" engraved on face of plate.

**2.6 SAFETY DEVICES**

- A. General: Area over which doors swing or slide shall be a safety section and anyone standing in path of door's movement shall be protected by a safety device.
- B. At sliding doors, provide two photoelectric beams mounted at heights of 600 mm (24 inches) and 1200 mm (48 inches) in the door frame on sliding doors. Provide overhead safety presence

**SECTION 08 71 13**  
**AUTOMATIC DOOR OPERATORS**

**2.6 SAFETY DEVICES (CONT)**

sensors at door head on each side of the opening. Beams shall parallel door openings to prevent doors from closing when anyone is in the center of the door or doors. When beams are activated, doors shall recycle to full open position. Actuation shall include a motion detector mounted on each side of the door for detection of traffic in each direction.

- C. Each swing door shall have installed on the pull side a presence sensor to detect any person standing in the door swing path and prevent the door from opening.
- D. Time delay switches shall be adjustable between 3 to 60 seconds to control closing cycle of doors.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Coordinate installation of equipment with other related work. Manual controls and power disconnect switches shall be recessed or semi-flush mounted in partitions. Secure operator components to adjacent construction with suitable fastenings. Conceal conduits, piping, and electric equipment, in finish work.
- B. Install power units in locations shown above ceilings. Where units are to be mounted on walls, provide metal supports or shelves for the units. All equipment, including time delay switches, shall be accessible for maintenance and adjustment.
- C. Operators shall be adjusted and function properly for traffic expected to pass through doors.
- D. Install controls at positions shown and make them convenient for particular traffic expected to pass through openings. Maximum height of push plate wall switches from finished floors shall be 40 inches unless otherwise approved by the Resident Engineer.

**3.2 INSTRUCTIONS**

- A. Following the installation and final adjustments of the door operators, the installer shall fully instruct VA personnel for 2 hours on the operating, servicing and safety requirements for the swing and sliding automatic door operators.
- B. Coordinate instruction to VA personnel with VA Resident Engineer.

- - - E N D - - -



**SECTION 08 71 13.11**  
**LOW ENERGY POWER ASSIST DOOR OPERATORS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies low energy power assisted automatic operation of swing doors. The door operator system shall be complete including operator, controls, door arm and operator enclosure (header and cover).

**1.2 RELATED WORK**

- A. Sealants; Section 07 92 00, JOINT SEALANTS.
- B. Aluminum frames entrance work; Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- C. Door hardware; Section 08 71 00, DOOR HARDWARE.
- D. Finish Color, Section 09 06 00, SCHEDULE FOR FINISHES.
- E. Electric general wiring, connections and equipment requirements; Division 26, ELECTRICAL.

**1.3 MANUFACTURER'S QUALIFICATIONS**

- A. Power assisted door operators, controls and other equipment shall be products of a manufacturer regularly engaged in manufacturing such equipment for a minimum of three years.
- B. One manufacturer of automatic door equipment shall be used throughout the building project.

**1.4 WARRANTY**

Power assisted door operators, controls and other related equipment shall be subject to the terms of the "Warranty of Construction", FAR clause 52.246-21, except that the warranty period shall be two years in lieu of one year.

**1.5 MAINTENANCE MANUALS**

In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS," furnish three copies of maintenance manuals and instructions on automatic door operators.

**1.6 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's literature and data describing operators, power units, controls, door hardware and safety devices.
- C. Shop Drawings:  
Showing location of controls and safety devices in relationship to each automatically operated door. This includes templates, wiring diagrams, fabrication details, anchorage and other information to providers of related work to coordinate the proper installation of the door operators.

**SECTION 08 71 13.11**  
**LOW ENERGY POWER ASSIST DOOR OPERATORS**

**1.7 DESIGN CRITERIA**

- A. Power assisted automatic door equipment shall accommodate normal traffic as well as the weight of the doors.
- B. Equipment: UL approved and comply with applicable codes. Motors shall be rated minimum one-quarter horsepower and shall be single phase and 115 volts.
- C. Electrical Wiring; Provide wiring so that only a single power supply is required. Equipment and wiring shall be as specified in Division 26, ELECTRICAL.

**1.8 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):  
ICC/ANSI A117.1-03.....Guideline for Accessible and Usable Buildings and  
Facilities-Providing Accessibility and Usability for  
Physically Handicapped People
- B. Builders Hardware Manufacturers Association, Inc. (BHMA):  
156.19-07 .....Power Assist and Low Energy Power Operated Doors

**PART 2 - PRODUCTS**

**2.1 OPERATORS**

- A. Automatic door operators shall be for commercial doors and shall be electromechanical and surface mounted above the door to the header or transom bar. The opening force shall be generated by a permanent magnet DC motor driving a combination spiral bevel/spur gear reducer and transmitted to the door through an arm linkage. Opening speed shall be adjustable and feature dual backcheck control allowing adjustment of backcheck speed and position. Closing shall be by spring force generated by a metal compression spring. The spring shall reduce manual opening force to not more than 67 N (15 lbf). The minimum diameter of spring wire shall be .007mm (172 in.). Under the specified design load of the door, the spring shall be capable of performing 2,000,000 cycles before fracture. Adjustable closing speed and fixed latch speed shall control the door in the closing cycle. The doors shall be operated manually at any time without damage to the operator or components.
- B. All operators shall have checking mechanism providing cushioning action at last part of door travel, in both opening and closing cycle. Operators shall recycle doors instantaneously to full open position from any point in closing cycle when control switch is reactivated.
- C. Operator shall be swinging type enclosed in housing. Operator shall open door by energizing motor and shall stop by electrically reducing voltage and stalling motor against mechanical stop. Door shall close by means of spring energy, and close force shall be controlled by gear system and motor being used as dynamic break without power. System shall operate as manual door control in event of power failure. Opening and closing speeds shall be adjustable:
  - 1. Swing Operator Housing: Housing shall be 140 mm (5-1/2 inches) wide by 150 mm (6 inches) high aluminum extrusions with enclosed end caps for application to 100



**SECTION 08 71 13.11**  
**LOW ENERGY POWER ASSIST DOOR OPERATORS**

**2.1 OPERATORS (CONT)**

- mm (4 inch) and larger frame systems. All structural sections shall have a minimum thickness of 3.7 mm (0.146 inch) and be fabricated of 6063-T5 aluminum alloy.
2. Swing Power Operator: Completely assembled and sealed unit which shall include helical gear drive transmission, mechanical spring and bearings, all located in cast aluminum case and filled with special lubricant for extreme temperature conditions. A "DC" shunt-wound permanent magnet motor with sealed ball bearings shall be attached to transmission system. Complete unit shall be rubber mounted with provisions for easy maintenance and replacement, without removing door from pivots or frame.
  3. Connecting hardware for swing overhead concealed type power operator shall have drive arm attached to door with a pin linkage rotating in a self-lubricating bearing and adjustable slide block, traveling in an interconnected track and top pivot assembly. Top track and pivot assembly shall be fabricated of steel. Door shall not pivot on shaft of operator.
  4. Electrical Control: Operator shall have a self contained electrical control unit, including necessary transformers, relays, rectifiers, and other electronic components for proper operation and switching of power operator. Relays shall be plug-in type for individual replacement and all connecting harnesses shall have interlocking plugs. Control shall also include time delay for normal cycle. Swing door control shall include safe-swing circuit with optional switching which automatically limits power and slows door when approached from the doors swing area.

**2.2 MICROPROCESSOR CONTROLS**

- A. The system shall include a multi-function microprocessor control providing adjustable hold open time (1 – 30 sec.), LED indications for actual position unknown, system status, open obstruction shutdown, activation signal, safety mat/sensor signal, Stop-and-Hold signal, and mode selector switches providing a means for easy field selection of the following functions: push-to-operate, latch assist and stack pressure. Control shall be capable of receiving activation signals from any device with normally open dry contact output.
  1. With push-to-operate function enabled, the control shall provide a means of initiating a self-start activation circuit by slightly pushing the door open at any point in the door swing.
  2. Latch Assist shall provide a two second impulse in the close direction to overcome restrictions with locking devices of pressure differentials, allowing the unit to operate in standard time delay mode, and permitting the door to close from the full open position after the hold time is satisfied. All activation modes shall provide fully adjustable opening speed.
- B. The door shall be held open by low voltage applied to the continuous duty motor. The control shall include an adjustable safety circuit that monitors door operation and shuts the motor off if an open obstruction is sensed. The control shall include a recycle feature the reopens the door if an obstruction is sensed at any point during its closing cycle. The control shall include a standard three position toggle switch with functions for ON, OFF, and HOLD OPEN.

**SECTION 08 71 13.11**  
**LOW ENERGY POWER ASSIST DOOR OPERATORS**

**2.3 ENCLOSURE**

Operator shall be completely self-contained within an extruded aluminum housing (alloy 6063-T6) to conceal operator mechanism and mounting brackets and with removable access cover with an overall maximum size of 140 mm (5-1/2 inches) wide by 150 mm (6 inches) deep. Header color shall be integral color anodized/painted to match adjacent storefront/frame finish.

**2.4 ACTIVATION DEVICES**

- A. Automatic: Opening cycle shall be activated by pressing switches with international symbol of accessibility and "PRESS TO OPERATE DOOR" engraved on the faceplate. Switches shall be installed in a standard 2-gang electrical wall box and placed in a location in compliance with ANSI A117.1. Switches may be wall mounted or mounted on a free standing post or guard rail.
- B. Manual: Push-to-operate; manually pushing the door shall activate the automatic opening cycle. Door shall automatically close after timer delay expires.
- C. Opening and closing force, measured 25 mm (1 inch) out from the lock stile of the door, shall not exceed 67 N (15 lbf) to stop the door when operating in either direction or cycle.
- D. Opening Time: Doors shall be field adjusted so that opening time to back check or 80 degrees, whichever occurs first, shall be 3 seconds or longer as required in Table 1. Backcheck shall not occur before 60 degrees opening. Total opening time to fully open shall be as in Table II.
- E. Closing Time:  
Doors shall be field adjusted to close from 90 degrees to 10 degrees in 3 seconds or longer as required in Table 1.
  - 1. Doors shall be field adjusted to close from 10 degrees to fully close position in not less than 1.5 seconds.
  - 2. Doors shall be field adjusted to remain fully open for not less than 5 seconds.
  - 3. Table 1 provides speed settings for various widths and weights of doors for obtaining results complying with this paragraph.
- F. Cycle Tests:
  - 1. Low Energy Power Operated, Low Energy Power Open and Power Assist Operators shall be cycle tested for 300,000 cycles.
  - 2. Use the widest and heaviest door specified as a test specimen. Narrower or lighter doors of the same configurations shall then be considered to meet the cycle test requirements.

**Table 1**

Minimum Opening Time to Backcheck or 80 degrees, which ever occurs first and the Minimum Closing Time from 90 degrees to Latch Check or 10 degrees.

"D" Door Leaf Width- mm (inches)	"W" Door Weight in kg (pounds)  Matrix Values are in seconds
--	--

**SECTION 08 71 13.11**  
**LOW ENERGY POWER ASSIST DOOR OPERATORS**

	(100) 45.4	(56.7) 125	(68.0) 150	(79.4) 175	(90.7) 200
(762) 30	3.0	3.0	3.0	3.0	3.5
(914) 36	3.0	3.5	3.5	4.0	4.0
(1067) 42	3.5	4.0	4.0	4.5	4.5

Doors of other weights and widths can be calculated using the formula;

$T = DvW/133$  in US units       $T = DvW/2260$  in SI (metric) units

Where: T= Time, seconds

D= Door width, mm (inches)

W= Door weight, kg (lbs)

The values for "T" time have been rounded up to the nearest half second.

These values are based on a kinetic energy of (1.25 lbf-ft).

**Table II**  
**Total Opening Time to Full Open Position**

Backcheck at 60 degrees	Backcheck at 70 degrees	Backcheck at 80 degrees
Table 1 plus 2 seconds	Table 1 plus 1.5 seconds	Table 1 plus 1 second

Note: To determine maximum times from close to full open, the operator shall be adjusted as shown in the chart. Backcheck occurring at a point between positions in Table II shall use the lowest setting. For example, if the backcheck occurs at 75 degrees, the full open shall be the time shown in Table 1 plus 1.5 seconds.

## **2.5 POWER UNITS**

Provide separate self-contained electric circuits for automatic operators located on each floor of the building. Interruption or failure of power circuits for operators located on one floor of the building shall not interfere with continuous performance of automatic operated doors located on other floors. Capacity and size of power circuits shall be in accordance with automatic operator manufacturer's specifications.

## **2.6 SAFETY DEVICES**

- A. Time delay switches shall be adjustable between 5 to 60 seconds and shall control closing cycle of doors.
- B. Decals with sign "In" or "Do Not Enter" shall be installed on both faces of each door where shown and shall conform to the requirements of ANSI/BHMA A156.19.
- C. Each swing door shall have installed a motion sensor to detect any person standing in the door swing path and prevent the door from opening.
- D. Motion sensors shall consist of detection modules, factory prepared to be attached to each side of the lock/strike stile, an armored flex link power cable and bracket assembly, factory prepared for attachment to the pivot stile; a logic board and a position encoder which shall mount to the operator. The detection modules shall contain transmitting and receiving diodes and sense multidimensional zones for detection of people and/or objects in the door area. Detection modules shall be high impact, shock resistant zinc

**SECTION 08 71 13.11**  
**LOW ENERGY POWER ASSIST DOOR OPERATORS**

**2.6 SAFETY DEVICES (CONT)**

castings with tinted lenses. The swing door sensor system shall provide complete operate and safety zone coverage. These zones shall be fully adjusted to meet specific jobsite conditions (sidewalls, adjacent panels, etc.) The system shall not be affected by ultrasonic, ambient light or radios frequencies within the vicinity of the swing door.

- E. Each swing door shall have installed a re-activation sensor mounted on the push-side door face near the top detect any person standing in the door swing path and prevent the door from closing. Wiring for the re-activation sensor between the door and frame shall be concealed in a power transfer device, hinge or pivot provided under Section 08 71 00; wire chase in door provided under door section.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Coordinate installation of equipment with other related work. Manual controls and power disconnect switches shall be recessed or semi-flush mounted in partitions. Secure operator components to adjacent construction with suitable fastenings. Conceal conduits, piping, and electric equipment in finish work.
- B. Install power units in locations shown. Where units are to be mounted on walls, provide metal supports or shelves for the units. All equipment, including time delay switches, shall be accessible for maintenance and adjustment.
- C. Operators shall be adjusted and must function properly for the type of traffic (pedestrians) expected to pass through doors. Each door leaf of pairs of doors shall open and close in synchronization. On pairs of doors, operators shall allow either door to be opened manually without the other door opening.
- D. Install controls at positions shown and make them convenient for particular traffic expected to pass through openings. Maximum height of push plate wall switches from finished floors shall be 40 inches unless otherwise approved by the Resident Engineer .

---- END ----

**SECTION 08 80 00**  
**GLAZING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies glass, plastic, related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.

**1.2 RELATED WORK**

- A. Factory glazed by manufacturer in following units:
  - 1. Sound resistant doors: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, and Section 08 14 00, WOOD DOORS.
  - 2. Mirrors: Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES.
  - 3. Section 08 51 13, ALUMINUM WINDOWS (Double Hung).
  - 4. Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS.
  - 5. Color of spandrel glass, tinted (heat absorbing or light reducing) glass, and reflective (metallic coated) glass: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 LABELS**

- A. Temporary labels:
  - 1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
  - 2. Label in accordance with NFRC (National Fenestration Rating Council) label requirements.
  - 3. Temporary labels shall remain intact until is approved by Resident Engineer.
- B. Permanent labels:
  - 1. Locate in corner for each pane.
  - 2. Label in accordance with ANSI Z97.1 and SGCC (Safety Glass Certification Council) label requirements.
    - a. Tempered glass.
    - b. Laminated glass or have certificate for panes without permanent label.
    - c. Organic coated glass.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Building Enclosure Vapor Retarder and Air Barrier:
  - 1. Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
  - 2. Maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- B. Glass Thickness:
  - 1. Select thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with ASCE 7 and applicable code.
  - 2. Test in accordance with ASTM E 1300.
  - 3. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.

**SECTION 08 80 00  
GLAZING**

**1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Certificates:
  - 1. Certificate on shading coefficient.
  - 2. Certificate on "R" value when value is specified.
- C. Warranty: Submit written guaranty, conforming to General Condition requirements, and to "Warranty of Construction" Article in this Section.
- D. Manufacturer's Literature and Data:
  - 1. Glass, each kind required.
  - 2. Insulating glass units.
  - 3. Transparent (one-way vision glass) mirrors.

**1.6 DELIVERY, STORAGE AND HANDLING**

- A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.
- B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.
- C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.
- D. Protect laminated security glazing units against face and edge damage during entire sequence of fabrication, handling, and delivery to installation location. Provide protective covering on exposed faces of glazing plastics, and mark inside as "INTERIOR FACE" or "PROTECTED FACE":
  - 1. Treat security glazing as fragile merchandise, and packaged and shipped in export wood cases with width end in upright position and blocked together in a mass. Storage and handling shall comply with Manufacturer's directions and as required to prevent edge damage or other damage to glazing resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, other environmental conditions, and contact with chemical solvents.
  - 2. Protect sealed-air-space insulating glazing units from exposure to abnormal pressure changes, as could result from substantial changes in altitude during delivery by air freight. Provide temporary breather tubes which do not nullify applicable warranties on hermetic seals.
  - 3. Temporary protections: The glass front and polycarbonate back of glazing shall be temporarily protected with compatible, peelable, heat-resistant film which will be peeled for inspections and re-applied and finally removed after doors and windows are installed at destination. Since many adhesives will attack polycarbonate, the film used on exposed polycarbonate surfaces shall be approved and applied by manufacturer.
  - 4. Edge protection: To cushion and protect glass clad, polycarbonate, and Noviflex edges from contamination or foreign matter, the four edges shall be sealed the depth of glazing with continuous standard-thickness Santoprene tape. Alternatively, continuous channel shaped extrusion of Santoprene shall be used, with flanges extending into face sides of glazing.

**SECTION 08 80 00  
GLAZING**

**1.6 DELIVERY, STORAGE AND HANDLING (CONT)**

**1.7 PROJECT CONDITIONS**

Field Measurements: Field measure openings before ordering tempered glass products. Be responsible for proper fit of field measured products.

**1.8 WARRANTY**

- A. Warranty: Conform to terms of "Warranty of Construction", FAR clause 52.246-21, except extend warranty period for the following:
1. Insulating glass units to remain sealed for 10 years.
  2. Laminated glass units to remain laminated for 5 years.

**1.9 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
- Z97.1-04 .....Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test.
- C. American Society for Testing and Materials (ASTM):
- C1363-05 ..... Thermal Performance of Building Assemblies, by Means of A Hot Box Apparatus
- C716-06 .....Installing Lock-Strip Gaskets and Infill Glazing Materials.
- C864-05 .....Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- C920-08 .....Elastomeric Joint Sealants.
- C964-07 .....Standard Guide for Lock-Strip Gasket Glazing.
- C1036-06 .....Flat Glass.
- C1172-09 .....Laminated Architectural Flat Glass.
- E84-09.....Surface Burning Characteristics of Building Materials.
- E1300-09.....Determining Load Resistance of Glass in Buildings.
- E2190-08.....Insulating Glass Unit
- D. Code of Federal Regulations (CFR):
- 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; 1977, with 1984 Revision.
- E. National Fenestration Rating Council (NFRC)
- F. Safety Glazing Certification Council (SGCC)2009:  
Certified Products Directory (Issued Semi-Annually).
- G. Unified Facilities Criteria (UFC):
- 4-010-01-2007 .....DOD Minimum Antiterrorism Standards for Buildings
- H. Glass Association of North America (GANA):
- Glazing Manual (Latest Edition)
- Sealant Manual (2008)
- I. American Society of Civil Engineers (ASCE):
- ASCE 7-10.....Wind Load Provisions

**SECTION 08 80 00  
GLAZING**

**PART 2 - PRODUCT**

**2.1 GLASS**

- A. Use thickness stated unless specified otherwise in assemblies.
- B. Clear Glass:
  - 1. ASTM C1036, Type I, Class 1, Quality q3
  - 2. Thickness, 6 mm (1/4 inch).
  - 3. Coordinate color/tint/coating to accommodate required security monitoring.
- A. Tinted Heat reflective and low emissivity coated glass:
  - 1. ASTM C1036, Type I, Class 2, Quality q3.
  - 2. Color:
  - 3. Thickness, 6 mm (1/4 inch)

**2.2 HEAT-TREATED GLASS**

- A. Clear Tempered Glass:
  - 1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
  - 2. Thickness, 6 mm (1/4 inch)
- B. Tinted Tempered Glass.
  - 1. ASTM C1048, Kind FT, Condition A, Type I, Class 2, Quality q3.
  - 2. Color: \_\_\_\_\_
  - 3. Thickness, 6 mm (1/4 inch)
- C. Tempered Patterned Glass (obscure):
  - 1. ASTM C1048, Kind FT, Type II, Class 1, Form 3, Quality q8, Finish f1, Pattern p3.
  - 2. Thickness, 10.7 mm (0.422 inch) as indicated

**2.3 COATED GLASS**

- A. Spandrel Glass:
  - 1. ASTM C1048, Kind HS, Condition B, Type I.
  - 2. Thickness, 6 mm (1/4 inch)
- B. Reflective Tempered Glass:
  - 1. ASTM C1048, Kind FT, Condition C, Type I, Class 1, Quality q3 with reflective metallic coating, having nominal values of 25 percent day light, 30 percent solar, and 7.9 percent ultraviolet transmittance within three percent plus or minus.
  - 2. Thickness, 6 mm (1/4 inch)
- C. Low-E Tempered Glass:
  - 1. ASTM C1048, Kind FT, Condition C, Type I, Class 1, Quality q3 with low emissivity pyrolytic coating having an E of 0.15.
  - 2. Apply coating to second surface of insulating glass units.
  - 3. Thickness, 4.8 mm (3/16 inch)
- D. Ceramic Coated Vision Glass:
  - 1. ASTM C1048, Kind // HS // // FT //, Condition C, Type I, Class // 1 // // 2 // // 3 //, Quality q3 with ceramic coating applied by silk-screen process.
  - 2. Pattern as indicated in Drawings.
  - 3. Apply coating to second surface of insulating glass units
  - 4. Thickness, 6 mm (1/4 inch)



**SECTION 08 80 00  
GLAZING**

**2.3 COATED GLASS (CONT)**

- E. Transparent Mirror (One-Way-Vision Glass):
  - 1. ASTM C1036, Type I, Class 1, Quality q2 or Class 3, Quality q3; Grey Glass.
  - 2. Thickness, 6 mm (1/4 inch)
  - 3. Coated one face with a hard adherent reflective film of chromium or other coating of proven equivalent durability.
  - 4. Visible light transmittance; eight percent, plus or minus two percent.
  - 5. Visible reflectance; sixty percent, plus or minus five percent.
  - 6. Light ratio; mirror side 10 or more; observer side one or less.
  - 7. Assemble with coating covered and protected with a layer of clear glass not less than 3 mm (1/8 inch) thick.
  - 8. Clean interface glass prior to assembly.
  - 9. Tape edge to seal interface and hold panes together.

**2.4 LAMINATED GLASS**

- A. Two or more lites of glass bonded with an interlayer material for use in building glazing
- B. Colored Interlayer:
  - 1. Use color interlayer ultraviolet light color stabilization.
- C. Use 1.5 mm (0.060 inch) thick interlayer for:
  - 1. Horizontal or Sloped glazing.
  - 2. Acoustical glazing.

**2.5 GLASS CLAD POLYCARBONATE SECURITY GLAZING ASSEMBLY**

- A. Use 1.3 mm (0.050 inch) polyurethane sheeting for interlayer between glass and polycarbonate.
- B. Clear Heat Strengthened Glass Clad Polycarbonate.
  - 1. Use ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3, outer glass panes.
  - 2. Use clear polycarbonate sheet, 3 mm (1/8 inch) thick core.
  - 3. Thickness, 11 mm (7/16 inch).
- C. Clear Tempered Glass Clad Polycarbonate:
  - 1. Use ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3, 3 mm (1/8 inch) thick outer glass panes.
  - 2. Use clear polycarbonate sheet, 3 mm (1/8 inch) thick core.
  - 3. Thickness, 11 mm (7/16 inch).
- D. Maximum Allowable Area: Laminated glazing shall not exceed 1.32 meter
- E. square unless glazing has been certified.

**2.6 INSULATING GLASS UNITS**

- A. Provide factory fabricated, hermetically sealed glass unit consisting of two panes of glass separated by a dehydrated air space and comply with ASTM E2190.
- B. Assemble units using glass types specified:
- C. Sealed Edge Units (SEU):
  - 1. Insulating Glass Unit Makeup
    - a. Outboard Lite
      - 1. Glass type: Tinted

**SECTION 08 80 00  
GLAZING**

**2.6 INSULATING GLASS UNITS (CONT)**

2. Glass Tint:
3. Nominal Thickness: 1 inch
4. Glass Strength: (Annealed, Heat-Strengthened, Tempered)
- b. Spacer
  1. Nominal Thickness: 1/2 inch
  2. Gas Fill: Air
- c. Inboard Lite
  1. Glass Type: Low-e
  2. Glass Tint: clear
  3. Nominal Thickness: 1/4 inch
  4. Glass Strength: (Annealed, Heat-Strengthened, Tempered)
2. Performance Characteristics (Center of Glass)
  - a. Visible Transmittance: 70%
  - b. Visible Reflectance: 11%
  - c. Winter U-factor (U-value): 0.29
  - d. Shading Coefficient (SC): 0.44
  - e. Solar heat Gain Coefficient (SHGC): 0.38
3. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
- D. Fused Edge Units, (FEU):
  1. Glass to glass sealed edges electrically fused.
  2. Air space not less than 4.8 mm (3/16 inch) wide up to 6 mm (1/4 inch) wide.
  3. R value not less than 1.5.
- E. FEU Clear Glass.
  1. Interior and exterior panes, ASTM C1036, Type I, Class 1, Quality q3, 3 mm (1/8 inch) thick.
  2. Thickness, 11 mm (7/16 inch) minimum.

**2.7 SWITCHABLE PRIVACY GLASS**

- A. Laminated glass assembly for clear glass panes with polyvinyl butyral film (PVB) 0.76 mm (0.030 inch) thick film on each side of polymer dispersed liquid crystal film (PDLC) core having electrical connections:
  1. With voltage PDLC core becomes transparent.
  2. Without voltage PDLC core becomes translucent.
- B. Electric Connections:
  1. Locate steel channel cap on one panel edges, integrally connected to glass panel.
  2. Integrally connect flexible steel conduit, not less than 1800 mm (six feet long), to steel channel cap. Provide threaded end fitting at free end.
  3. Integrally connect type TFFN or THHN number 18 AWG minimum size to panel with not less than 150 mm (six inches) extending beyond flexible conduct end.
- C. Power Conditioner:
  1. Designed to provide square wave electrical power to discharge the LC film, suppress voltage surges and transients, reduces inrush current, and reliably discharge the LC film.
  2. Operate from 120 volt AC, 60 Hz input.

**SECTION 08 80 00**  
**GLAZING**

**2.7 SWITCHABLE PRIVACY GLASS (CONT)**

- D. Switchable privacy glass assembly listed by UL in Building Materials Directory or other approved testing laboratory bearing permanent mark of approval.
- E. Switchable privacy glass:
  - 1. Both panes ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3, 4.8 mm (3/16 inch) thick.
  - 2. Size as indicated.
  - 3. Thickness as indicated
- F. Switchable Privacy Glass system meeting the above specifications as manufactured by Polytronics Corporation, Telephone No. 972-238-7045, is acceptable.

**2.8 GLAZING ACCESSORIES**

- A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.
- B. Setting Blocks: ASTM C864:
  - 1. Channel shape; having 6 mm (1/4 inch) internal depth.
  - 2. Shore a hardness of 80 to 90 Durometer.
  - 3. Block lengths: 50 mm (two inches) except 100 to 150 mm (four to six inches) for insulating glass.
  - 4. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
  - 5. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.
- C. Spacers: ASTM C864:
  - 1. Channel shape having a 6 mm (1/4 inch) internal depth.
  - 2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
  - 3. Lengths: One to 25 to 76 mm (one to three inches).
  - 4. Shore a hardness of 40 to 50 Durometer.
- D. Sealing Tapes:
  - 1. Semi-solid polymeric based material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
  - 2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.
- G. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular or diamond shaped pieces, 6 mm (1/4 inch) minimum size.
- H. Glazing Gaskets: ASTM C864:
  - 1. Firm dense wedge shape for locking in sash.
  - 2. Soft, closed cell with locking key for sash key.
  - 3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.
- I. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.
- J. Glazing Sealants: ASTM C920, silicone neutral cure:
  - 1. Type S.
  - 2. Class 25
  - 3. Grade NS.
  - 4. Shore A hardness of 25 to 30 Durometer.

**SECTION 08 80 00  
GLAZING**

**2.8 GLAZING ACCESSORIES (CONT)**

- K. Structural Sealant: ASTM C920, silicone acetoxycure:
  - 1. Type S.
  - 2. Class 25.
  - 3. Grade NS.
  - 4. Shore a hardness of 25 to 30 Durometer.
- M. Color:
  - 1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall match color of the finished aluminum and be nonstaining.
  - 2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.
- N. Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units intended for removal for smoke control. Comply with requirements of local Fire Department.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verification of Conditions:
  - 1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
  - 2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer's approved shop drawings.
- B. Advise Contractor of conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation: Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units to prevent damage to glass and glazing units by cleaning materials.

**3.2 PREPARATION**

- A. For sealant glazing, prepare glazing surfaces in accordance with GANA-02 Sealant Manual.
- B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.
- C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.
- D. Verify that components used are compatible.
- E. Clean and dry glazing surfaces.
- F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

**3.3 INSTALLATION - GENERAL**

- A. Install in accordance with GANA-01 Glazing Manual and GANA-02 Sealant Manual unless specified otherwise.

**SECTION 08 80 00  
GLAZING**

**3.3 INSTALLATION - GENERAL (CONT)**

- B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.
- C. Set glazing without bending, twisting, or forcing of units.
- D. Do not allow glass to rest on or contact any framing member.
- E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. Patterned Glass:
  - 1. Install units with one patterned surface with smooth surface on the weather side.
  - 2. Install units in interior partitions with pattern in same direction in all openings.
- G. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.
- H. Transparent (One-Way Vision Glass) Mirror: Use continuous channel glazing gasket.
- J. Laminated Glass:
  - 1. Tape edges to seal interlayer and protect from glazing sealants.
  - 2. Do not use putty or glazing compounds.
- K. Insulating Glass Units:
  - 1. Glaze in compliance with glass manufacturer's written instructions.
  - 2. When glazing gaskets are used, they shall be of sufficient size and depth to cover glass seal or metal channel frame completely.
  - 3. Do not use putty or glazing compounds.
  - 4. Do not grind, nip, cut, or otherwise alter edges and corners of fused glass units after shipping from factory.
  - 5. Install with tape or gunnable sealant in wood sash.

**3.4 INSTALLATION - DRY METHOD (TAPE AND GASKET SPLINE GLAZING)**

- A. Cut glazing tape to length; install on glazing pane. Seal corners by butting and sealing junctions with butyl sealant.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Trim protruding tape edge.

**3.5 INSTALLATION - WET/DRY METHOD (PREFORMED TAPE AND SEALANT)**

- A. Cut glazing tape to length and set against permanent stops, 5 mm (3/16 inch) below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- C. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.

**SECTION 08 80 00  
GLAZING**

**3.5 INSTALLATION - WET/DRY METHOD (PREFORMED TAPE AND SEALANT) (CONT)**

- D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to achieve full contact at perimeter of pane or glass unit.
- E. Install removable stops, with spacer strips inserted between glazing and applied stops, 6 mm (1/4 inch) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.
- F. Fill gap between glazing and stop with \_\_\_\_\_ type sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line.
- G. Apply cap bead of \_\_\_\_\_ type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

**3.6 INSTALLATION - WET METHOD (SEALANT AND SEALANT)**

- A. Place setting blocks at 1/4 points and install glazing pane or unit.
- B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- C. Fill gaps between glazing and stops with \_\_\_\_\_ type sealant to depth of bite on glazing, but not more than 9 mm (3/8 inch) below sight line to ensure full contact with glazing and continue the air and vapor seal.
- D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

**3.7 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND)**

- A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 600 mm (24 inch) centers, kept 6 mm (1/4 inch) below sight line.
- B. Locate and secure glazing pane using glazers' clips.
- C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

**3.8 PROTECTION**

Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

**3.9 GLAZING SCHEDULE**

- B. Tempered Glass:
  - 1. Install in full and half glazed doors unless indicated otherwise.
  - 2. Install in storefront, windows, and door sidelights adjacent to doors at interior
  - 3. Use clear tempered glass on interior side lights and doors
  - 4. Use SEU clear tempered insulating glass on storefronts and sidelights, exterior.
  - 5. Use SEU Low E tempered and clear glass, G-41, on curtain wall.
  - 6. Use clear tempered glass in exterior and interior panes unless specified otherwise at insulating glass units adjacent to door.
- D. Clear Glass:
  - 1. Interior observation windows not specified otherwise.
  - 2. Interior pane of dual glazed windows not receiving tempered, laminated or organic coated glass, or other special glass indicated or specified.

**SECTION 08 80 00**  
**GLAZING**

- E. Tinted Glass: Exterior pane of dual glazed windows not receiving tinted tempered glass.
- F. Insulating Glass:
  - 1. Install SEU clear tempered glass in windows, storefronts, curtain walls, adjacent to entrances or walks.
  - 2. Install SEU clear glass in windows, storefronts,
  - 3. Install tinted tempered and laminated glass in skylights and other overhead conditions.
- G. Laminated Glass: Install as specified in doors, observation windows and interior pane of dual glazed windows where indicated.
  - 1. Provide laminated glass for all windows in Psychiatric Security Bedrooms.  
Laminated glass shall be 7/16-in thick in locked patient units and security rooms, 5/16-in thick elsewhere.(min. 1.5 mm interlayer).
- I. Transparent Mirror (One-Way-Vision Glass): Install in observation windows where indicated.
- J. Pattern Glass (obscure):
  - 1. Install in interior pane of dual glazed windows of toilets, baths, and locker rooms and where indicated.
  - 2. Pattern Glass (obscure), unless specified otherwise.
  - 4. Other Doors: Use tempered patterned glass.
- K. Spandrel Glass: Install specified spandrel glazing where indicated.

- - - E N D - - -





**SECTION 08 90 00  
LOUVERS AND VENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies fixed and operable wall louvers, door louvers and wall vents.

**1.2 RELATED WORK**

- A. Louvers in steel doors: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- B. Color of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:  
Each type, showing material, finish, size of members, method of assembly, and installation and anchorage details.
- C. Manufacturer's Literature and Data:  
Each type of louver and vent.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The Master Painters Institute (MPI):  
Approved Product List - September 2011
- C. American Society for Testing and Materials (ASTM):
  - A1008/ A1008M-10.....Steel, Sheet, Carbon, Cold Rolled, Structural, and High Strength Low-Alloy with Improved Formability
  - B209/ B209M-03(R2007).....Aluminum and Aluminum Alloy, Sheet and Plate
  - B221-08.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - B221M-07 .....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire Shapes, and Tubes
- D. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06.....Metal Finishes Manual
- E. American Architectural Manufacturers Association (AAMA):  
2605-11 .....High Performance Organic Coatings on Architectural Extrusions and Panels
- F. Air Movement and Control Association, Inc. (AMCA):  
500-L-07 .....Testing Louvers

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Aluminum, Extruded: ASTM B221/ B221M.
- B. Carbon Steel: ASTM A1008/ A1008M.
- C. Aluminum, Plate and Sheet: ASTM B209/ B209M.

**SECTION 08 90 00  
LOUVERS AND VENTS**

**2.1 MATERIALS (CONT)**

- D. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or shown, shall be toggle or expansion bolts, of size and type as required for each specific type of installation and service condition.
  - 1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
  - 2. Fasteners for louvers, louver frames, and wire guards shall be of stainless steel or aluminum.
- E. Inorganic Zinc Primer: MPI No. 19.

**2.2 EXTERIOR WALL LOUVERS**

- A. General:
  - 1. Provide fixed type louvers of size and design shown.
  - 2. Heads, sills and jamb sections shall have formed caulking slots or be designed to retain caulking. Head sections shall have exterior drip lip, and sill sections an integral water stop.
  - 3. Furnish louvers with sill extension or separate sill as shown.
  - 4. Frame shall be mechanically fastened or welded construction with welds dressed smooth and flush.
- B. Performance Characteristics:
  - 1. Weather louvers shall have a minimum of 50 percent free .
  - 2. Louvers shall bear AMCA certified rating seals for air performance and water penetration ratings.
- C. Aluminum Louvers:
  - 1. General: Frames, blades, sills and mullions (sliding interlocking type); 2 mm (0.081-inch) thick extruded aluminum. Blades shall be drainable type and have reinforcing bosses.
  - 2. Louvers, fixed: Make frame sizes 13 mm (1/2-inch) smaller than openings. Single louvers frames shall not exceed 1700 mm (66 inches) wide. When openings exceed 1700 mm (66 inches), provide twin louvers separated by mullion members.

**2.3 CLOSURE ANGLES AND CLOSURE PLATES**

- A. Fabricate from 2 mm (0.074-inch) thick stainless steel or aluminum.
- B. Provide continuous closure angles and closure plates on inside head, jambs and sill of exterior wall louvers.
- C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as specified.

**2.4 WIRE GUARDS**

- A. Provide wire guards on outside of all exterior louvers, except on exhaust air louvers.
- B. Fabricate frames from 2 mm (0.081-inch) thick extruded or sheet aluminum designed to retain wire mesh.
- C. Wire mesh shall be woven from not less than 1.6 mm (0.063-inch) diameter aluminum wire square mesh.

**SECTION 08 90 00  
LOUVERS AND VENTS**

**2.4 WIRE GUARDS (CONT)**

- D. Miter corners and join by concealed corner clips or locks extending about 57 mm (2-1/4 inches) into rails and stiles. Equip wire guards over four feet in height with a mid-rail constructed as specified for frame components.
- E. Fasten frames to outside of louvers with aluminum or stainless steel devices designed to allow removal and replacement without damage to the wire guard or the louver.

**2.5 EXTERIOR DOOR LOUVERS**

- A. Fabricate of 1.6 mm (0.063-inch) thick extruded aluminum. Miter frames at corners and join by concealed corner brackets.
- B. Equip louvers on outside with wire guards, except omit wire guards for louvers in doors located completely below enclosed areaways.

**2.6 INTERIOR DOOR LOUVERS**

- A. Fabricate louvers for interior doors and partitions of 1.2 mm (0.0478-inch) thick steel
- B. Make louvers sight-proof type with stationary blades,
- C. Lightproof louvers shall have stationary blades and be designed to exclude passage of light but permit free ventilation.

**2.7 WALL VENTS**

- A. Fabricate exterior wall vents from either 4.7 mm (0.187-inch) thick aluminum plate of 6 mm (1/4-inch) thick cast iron, perforated in diamond lattice pattern, with not over 19 mm (3/4-inch) openings.
- B. Vents shall have aluminum screen frame with aluminum alloy insect screening mounted on back of vent by means of 19 mm x 5 mm (3/4-inch by 3/16-inch) top and bottom bars screwed to grille.
- C. Vent Frames In Masonry: Fabricate of 45 mm x 30 mm x 5 mm (1-3/4 inch by 1-1/4 inch by 3/16-inch) steel angles bolted with 6 mm (1/4-inch) diameter expansion bolts at jambs.

**2.8 AIR INTAKE VENTS**

- A. Fabricate exterior louvered wall ventilators for fresh air intake for air conditioning units from extruded aluminum, ASTM B221. Form with integral horizontal louvers and frame, with drip extending beyond face of wall and integral water stops.

**2.9 FINISH**

- A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505
- B. Aluminum Louvers Wire Guards:
  - 1. Anodized finish
    - a. AA-M1X Mill finish, as fabricated.
  - 2. Organic Finish: AAMA 2605 (Fluorocarbon coating).
- C. Sheet Steel: Baked-on or oven dried shop prime coat.
  - 1. Paint interior surfaces of lightproof louvers with two additional finish shop coats of baked-on flat black enamel.

**SECTION 08 90 00  
LOUVERS AND VENTS**

**2.9 FINISH (CONT)**

2. Finish painting of exposed surfaces of shop primed louvers is specified in Section 09 91 00, PAINTING.
- D. Steel: Surfaces of steel work, for which no other finish is specified, shall be cleaned free from scale, rust, oil and grease, and then given a light colored prime paint after fabrication, except ferrous metals concealed in finished work. Paint all contact surfaces of assembled work (except welded contact surfaces) with an additional shop coat of similar paint.

**2.10 PROTECTION**

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with a heavy coat of bituminous paint (complete coverage), or by separating the contact surfaces with a performed synthetic rubber tape having pressure sensitive adhesive coating on one side.
- B. Protect finished surfaces from damage during fabrication, erection, and after completion of the work

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Furnish setting drawings and instructions for installation of anchors Provide temporary bracing for such items until masonry is set.
- C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers and vents to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.
- D. Generally, set wall louvers and vents in masonry walls during progress of the work. If wall louvers and vents are not delivered to job in time for installation in prepared openings, make provision for later installation.

**3.2 CLEANING AND ADJUSTING**

- A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum shall be cleaned as recommended by the manufacturer and protected from damage until completion of the project.
- B. All movable parts, including hardware, shall be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components

- - - E N D - - -

**SECTION 09 06 00  
SCHEDULE FOR FINISHES**

**PART I - GENERAL**

**1.1 DESCRIPTION**

This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule or shown for other locations.

**1.2 MANUFACTURERS**

Manufacturer's trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer's equivalent to colors, finishes, textures, patterns and Design Basis' of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by contracting officer for finish requirements.

**1.3 SUBMITALS**

Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES-provide quadruplicate samples for color approval of materials and finishes specified in this section.

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. MASTER PAINTING INSTITUTE: (MPI)  
2001 .....Architectural Painting Specification Manual.P

**PART 2- PRODUCTS**

2.1 Items that will be found in the Finish Schedule included:

**2.2 DIVISION 31 - EARTHWORK**

- A. SECTION 32 31 13, CHAIN LINK FENCES AND GATES
- B. SECTION 32 17 23, PAVEMENT MARKINGS.

**2.3 DIVISION 03 - CONCRETE**

- A. Architectural Colored Concrete
- B. SECTION 03 45 00, PRECAST ARCHITECTURAL CONCRETE

**2.4 DIVISION 04 - MASONRY**

- A. Section 04 05 13, MASONRY MORTARING and Section 04 05 16, MASONRY GROUTING
- B. Section 04 20 00, UNIT MASONRY
- C. STONE MASONRY
- D. STONE FACING

**SECTION 09 06 00  
SCHEDULE FOR FINISHES**

**2.5 DIVISION 05 - METALS**

- A. SECTION 05 50 00, METAL FABRICATION
- B. SECTION 05 51 00, METAL STAIRS

**2.6 DIVISION 06 WOOD, PLASTICS, AND COMPOSITES**

- A. SECTION 06 20 00, FINISH CARPENTRY

**2.7 DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

- A. SECTION 07 40 00, SIDING PANELS
- B. SECTION 07 53 23, ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING

**2.7 DIVISION 07 - THERMAL AND MOISTURE PROTECTION (CONT)**

- C. SECTION 07 18 13, PEDESTRIAN TRAFFIC COATINGS
- D. SECTION 07 60 00, FLASHING AND SHEET METAL
- E. SECTION 07 71 00 / 07 72 00, ROOF SPECIALITIES AND ACCESSORIES
- F. SECTION 07 92 00, JOINT SEALANTS

**2.8 DIVISION 08 - OPENINGS**

- A. SECTION 08 11 13, HOLLOW METAL DOORS AND FRAMES
- B. SECTION 08 14 00, WOOD DOORS
- C. SECTION 08 31 13, ACCESS DOORS AND FRAMES
- E. SECTION 08 33 00, COILING DOORS AND GRILLES
- F. SECTION Doors 08 35 13.13, ACCORDION FOLDING
- G. SECTION 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
- H. SECTION 08 51 13, ALUMINUM WINDOWS
- I. SECTION 08 56 19, PASS WINDOWS
- J. SECTION 08 71 00, BUILDERS HARDWARE
- K. SECTION 08 80 00, GLAZING

**2.9 DIVISION 09 - FINISHES**

- A. SECTION 09 30 13, CERAMIC TILING (CT)
- B. SECTION 09 66 13, PORTLAND CEMENT TERRAZZO FLOORING (TER)
- D. SECTION 09 66 16, TERRAZZO TILE GROUT
- E. SECTION 09 51 00, ACOUSTICAL CEILINGS (AT)
- H. SECTION 09 65 16, WELDED SEAM SHEET FLOORING (WSF)
- I. SECTION 09 65 13, RUBBER BASE (RB)
- J. SECTION 09 68 00, CARPET MODULES (CPT)
- K. SECTION 09 67 23, EPOXY RESINOUS FLOORING (RES)

**SECTION 09 06 00  
SCHEDULE FOR FINISHES**

**2.9 DIVISION 09 - FINISHES (CONT)**

N. SECTION 09 91 00, PAINT AND COATINGS (P)

1. MPI Gloss and Sheen Standards

Gloss @60

Sheen @85

Gloss Level 4 a "satin-like" finish

20-35 units,

and min. 35 units

Gloss Level 5 a traditional semi-gloss

35-70 units

O. SECTION 09 72 16, VINYL WALLCOVERING (W)

**2.10 DIVISION 10 - SPECIALTIES**

A. SECTION 08 90 00, LOUVERS AND WALL VENTS

B. SECTION 10 26 00, WALL GUARDS AND CORNER GUARDS (CG),(CR)

C. SECTION 10 13 00 / 10 14 00, EXTERIOR SIGNS

D. SECTION 10 13 00 / 10 14 00, INTERIOR SIGNS

E. SECTION 10 44 13, FIRE EXTINGUISHER CABINETS

F. SECTION 10 28 00, TOILET AND BATH ACCESSORIES

**2.11 DIVISION II - EQUIPMENT**

**2.12 DIVISION 12- FURNISHINGS**

A. SECTION 12 36 00, COUNTERTOPS AND ACCESSORIES (HPDL) (S)

B. SECTION 12 24 21, LIGHTPROOF SHADES

**2.13 DIVISION 13 - SPECIAL CONSTRUCTION**

**2.15 DIVISION 22 - PLUMBING**

A. SECTION 22 40 00, PLUMBING FIXTURES AND TRIM

**2.16 DIVISION 26 - ELECTRICAL**

**SECTION 09 06 00  
SCHEDULE FOR FINISHES**

**PART III EXECUTION**

**3.1 FINISH SCHEDULES & MISCELLANEOUS ABBREVIATIONS**

FINISH SCHEDULE & MISCELLANEOUS ABBREVIATIONS	
Term	Abbreviation
Acoustical Ceiling	AT
Acoustical Ceiling, Special Protection	AT (SP)
Art Panel	AP
Carpet Module Tile	CPT
Ceramic Tile	CT
Concrete	C
Concrete Masonry Unit	CMU
Ceramic Tile	CT
Crash Rail	CR
Drapery	DR
Exposed Ceiling	EXP
Epoxy Paint	EP
Fiberglass Reinforced Panel	FRP
Glass Tile	G
Gypsum Wall Board, 2 Layers	GWB(2)
Gypsum Wall Board, Impact Resistant	GWB-IR
Hand Rail	HR
Gypsum Wallboard	GWB
Linoleum Flooring Tile	LN-T
Linoleum Chemically Welded	LN-CW

Seams	
Linoleum Flooring	LN
Linoleum Sheet Goods	SW
Linear Wood Ceiling	LWC
Non-Porous Paint	RES-W
Paint	P
Padded Wall System	PWS
Plastic Laminate	HPDL
Poured Terrazzo Floor	TER
Rubber Base	RB
Resin Floor	ERF
Resin Panel	SW
Solid Surface	S
Stone	S
Terrazzo Tile	TT
Vinyl Wallcovering	W
Welded Seams Vinyl Sheet Flooring	WSF
Walk Off Mats	WM
Wood	WD

**3.2 FINISH SCHEDULE SYMBOLS**



**SECTION 09 06 00  
SCHEDULE FOR FINISHES**

**Symbol Definition**

\*\* Same finish as adjoining walls  
- No color required  
E Existing  
XX To match existing  
EFTR Existing finish to remain  
RM Remove

**3.3 ROOM FINISH SCHEDULE**

--- E N D---



**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies steel studs wall systems, shaft wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, plaster bases or other building boards.
- B. "Design, furnish and install seismic restraint systems per the requirements of Section 13 05 41 as required for compliance with the 2009 International Building Code and Department of Veterans Affairs H-18-8, Seismic Design Requirements. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. Refer to Section 13 05 41 for additional information. If the requirements of this Section conflict with Section 13 05 41 the more stringent requirement shall govern."

**1.2 RELATED WORK**

- A. Load bearing framing: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.
- D. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS Section 09 29 00, GYPSUM BOARD.

**1.3 TERMINOLOGY**

- A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

**1.4 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

In accordance with the requirements of ASTM C754.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society For Testing And Materials (ASTM)
  - A123-09.....Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
  - A653/ A653M-09.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
  - A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire
  - C635-07 .....Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings

**SECTION 09 22 16  
NON-STRUCTURAL METAL FRAMING**

**1.5 APPLICABLE PUBLICATIONS (CONT)**

C636-06 .....	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
C645-09 .....	Non-Structural Steel Framing Members
C754-09 .....	Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
C1002-07 .....	Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
E580-09 .....	Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

**PART 2 - PRODUCTS**

**2.1 PROTECTIVE COATING**

Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G-60 minimum, per ASTM 123.

**2.2 STEEL STUDS AND RUNNERS (TRACK)**

- A. ASTM C645, modified for thickness specified and sizes as shown.
  - 1. Use ASTM A525 steel, 0.8 mm (0.0329-inch) thick bare metal (33 mil).
  - 2. Runners same thickness as studs.
- B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
- C. Doubled studs for openings and studs for supporting concrete backer-board.
- D. Studs 3600 mm (12 feet) or less in length shall be in one piece.

**2.3 FURRING CHANNELS**

- A. Rigid furring channels (hat shape): ASTM C645.
- B. Resilient furring channels:
  - 1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
  - 2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
- C. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

**2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES**

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.

**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

**2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES (CONT)**

- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.
- E. Tie Wire and Hanger Wire:
  - 1. ASTM A641, soft temper, Class 1 coating.
  - 2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- F. Attachments for Wall Furring:
  - 1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
  - 2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.
- G. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

**2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD (OPTION)**

- A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.
- B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

**PART 3 - EXECUTION**

**3.1 INSTALLING STUDS**

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Space studs not more than 610 mm (24 inches) on center.
- C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.
- D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.
- E. Extend studs to underside of structure overhead for sound rated partitions and insulated exterior wall furring.
- F. Openings:
  - 1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
  - 2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
  - 3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.
- G. Fastening Studs:
  - 1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
  - 2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

**3.1 INSTALLING STUDS (CONT)**

- H. Form building seismic or expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the seismic or expansion joint.
- I. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

**3.2 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES**

- A. Provide for attachment and support of electrical outlets, plumbing, heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers s, wall-hung casework, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.
- B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

**3.3 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS**

- A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.
  - 1. Space framing at 400 mm (16-inch) centers for metal lath anchorage.
  - 2. Space framing at 600 mm (24-inch) centers for gypsum board anchorage.
- B. Concrete slabs on steel decking composite construction:
  - 1. Use pull down tabs when available.
  - 2. Use power activated fasteners when direct attachment to structural framing can not be accomplished.
- C. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.
- D. Installing suspended ceiling system for gypsum board (ASTM C635 Option):
  - 1. Install only for ceilings to receive screw attached gypsum board.
  - 2. Install in accordance with ASTM C636.
    - a. Install main runners spaced 1200 mm (48 inches) on center.
    - b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
    - c. Install wall track channel at perimeter.
- E. Installing Ceiling Bracing System:
  - 1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and over head construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.
  - 2. Install bracing at an approximate 45 degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.
  - 3. Brace suspended ceiling or soffit framing in seismic areas in accordance with ASTM E580.

**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

**3.4 TOLERANCES**

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8-inch.)
- C. Level or align ceilings within 3 mm (1/8-inch.)

- - - E N D - - -





**SECTION 09 29 00  
GYPSUM BOARD**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies installation and finishing of gypsum board.

**1.2 RELATED WORK**

- A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 05 40 00, COLD-FORMED METAL FRAMING, and Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- B. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.
- C. Lay in gypsum board ceiling panels: Section 09 51 00, ACOUSTICAL CEILING.

**1.3 TERMINOLOGY**

- A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.
- C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

**1.4 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

In accordance with the requirements of ASTM C840.

**1.5 ENVIRONMENTAL CONDITIONS**

In accordance with the requirements of ASTM C840.

**1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing And Materials (ASTM):
  - C11-08 ..... Terminology Relating to Gypsum and Related Building Materials and Systems
  - C475-02 ..... Joint Compound and Joint Tape for Finishing Gypsum Board
  - C840-08 ..... Application and Finishing of Gypsum Board
  - C919-08 ..... Sealants in Acoustical Applications
  - C954-07 ..... Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
  - C1002-07 ..... Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - C1396-06 ..... Gypsum Board
  - E84-08..... Surface Burning Characteristics of Building Materials

**SECTION 09 29 00  
GYPSUM BOARD**

**1.6 APPLICABLE PUBLICATIONS (CONT)**

- C. Underwriters Laboratories Inc. (UL):  
Latest Edition.....Fire Resistance Directory
- D. Inchcape Testing Services (ITS):  
Latest Editions ..... Certification Listings

**PART 2 - PRODUCTS**

**2.1 GYPSUM BOARD**

- A. Gypsum Board: ASTM C1396, 16 mm (5/8 inch) thick unless shown otherwise.
- B. Water Resistant Gypsum Backing Board: ASTM C3273, 16 mm (5/8 inch) thick.
- C. Impact Resistant Board: ASTM C3273, 16 mm (5/8 inch)
- D. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise

**2.2 ACCESSORIES**

- A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.
- B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

**2.3 FASTENERS**

- A. ASTM C1002 and ASTM C840, except as otherwise specified.
- B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).
- C. Select screws of size and type recommended by the manufacturer of the material being fastened.
- E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

**2.4 FINISHING MATERIALS AND LAMINATING ADHESIVE**

ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

**PART 3 - EXECUTION**

**3.1 GYPSUM BOARD HEIGHTS**

- A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:
  - 1. Two sides of partitions:
    - a. Sound rated partitions.
    - b. Full height partitions shown (FHP).
    - c. Corridor partitions.
  - 2. One side of partitions or furring:
    - a. Inside of exterior wall furring or stud construction.
    - b. Room side of room without suspended ceilings.
    - c. Furring for pipes and duct shafts

**SECTION 09 29 00  
GYPSUM BOARD**

**3.1 GYPSUM BOARD HEIGHTS (CONT)**

- B. In locations other than those specified, extend gypsum board from floor to heights as follows:
  - 1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
  - 2. At ceiling of suspended gypsum board ceilings.

**3.2 INSTALLING GYPSUM BOARD**

- A. Coordinate installation of gypsum board with other trades and related work.
- B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
- C. Moisture and Mold-Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.
- D. Use gypsum boards in maximum practical lengths to minimize number of end joints.
- E. Bring gypsum board into contact, but do not force into place.
- F. Ceilings:
  - 1. For single-ply construction, use perpendicular application.
- G. Walls (Except Shaft Walls):
  - 1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
  - 2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
  - 3. Stagger screws on abutting edges or ends.
  - 4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
  - 5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
  - 6. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply application requirements.
  - 7. Installing Two Layer Assembly:
    - a. Apply face layer of wallboard vertically with joints staggered over framing members.
    - b. Fasten face layer with screw, of sufficient length to secure to framing, spaced 300 mm (12 inches) on center around perimeter, and 400 mm (16 inches) on center in the field.
  - 8. Control Joints ASTM C840 and as follows:
    - a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
    - b. Not required for wall lengths less than 9000 mm (30 feet).
    - c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.
- H. Acoustical or Sound Rated Partitions:
  - 1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
  - 2. Coordinate for application of caulking or sealants to space prior to taping and finishing.

**SECTION 09 29 00  
GYPSUM BOARD**

**3.2 INSTALLING GYPSUM BOARD (CONT)**

3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.
- I. Electrical and Telecommunications Boxes:
  1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.
- J. Accessories:
  1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
  2. Install in one piece, without the limits of the longest commercially available lengths.
  3. Corner Beads:
    - a. Install at all vertical and horizontal external corners and where shown.
    - b. Use screws only. Do not use crimping tool.
  4. Edge Trim (casings Beads):
    - a. At both sides of expansion and control joints unless shown otherwise.
    - b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
    - d. Where shown.

**3.5 FINISHING OF GYPSUM BOARD**

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all finished areas open to public view.
- B. Before proceeding with installation of finishing materials, assure the following:
  1. Gypsum board is fastened and held close to framing or furring.
  2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.
- C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non decorated and sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the sound rated construction/  
Sanding is not required of non decorated surfaces.

**3.6 REPAIRS**

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.
- B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide STC equivalent to the sound rated construction

**SECTION 09 29 00  
GYPSUM BOARD**

**3.7 UNACCESSIBLE CEILINGS**

At Detention Units, areas accessible to patients and not continuously observable by staff (e.g., patient bedrooms, day rooms), ceilings should be a solid material such as gypsum board. This will limit patient access. Access doors are needed to access electrical and mechanical equipment above the ceiling. These doors should be locked to prevent unauthorized access and secured to ceiling using tamper resistant fasteners.

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**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies ceramic, and porcelain waterproofing membranes for thin-set applications, crack isolation membranes, tile backer board.

**1.2 RELATED WORK**

- A. Sealing of joints where specified: Section 07 92 00, JOINT SEALANTS.
- B. Color, texture and pattern of field tile and trim shapes, size of field tile, trim shapes, and color of grout specified: Section 09 06 00, SCHEDULE FOR FINISHES
- C. Metal and resilient edge strips at joints with new resilient flooring, Section 09 65 19, RESILIENT TILE FLOORING

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Base tile, each type, each color, each size.
  - 2. Porcelain tile, each type, color, patterns and size.
  - 3. Wall (or wainscot) tile, each color, size and pattern.
  - 4. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.
- C. Product Data:
  - 1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
  - 2. Chemical resistant mortar and grout (Epoxy and Furan).
  - 3. Cementitious backer unit.
  - 4. Dry-set Portland cement mortar and grout.
  - 5. Elastomeric membrane and bond coat.
  - 6. Latex-Portland cement mortar and grout
  - 7. Organic adhesive.

**1.4 DELIVERY AND STORAGE**

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
  - A10.20-05.....Safety Requirements for Ceramic Tile, Terrazzo, and Marble Works
  - A108.1A-05.....Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar

**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

**1.5 APPLICABLE PUBLICATIONS (CONT)**

- A108.1B-05 ..... Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with dry-Set or latex-Portland Cement Mortar
- A108.4-05 ..... Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesives
- A108.6-05 ..... Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy
- A108.10-05 ..... Installation of Grout in Tilework
- A108.11-05 ..... Interior Installation of Cementitious Backer Units
- A118.1-05 ..... Dry-Set Portland Cement Mortar
- A118.3-05 ..... Chemical Resistant, Water Cleanable Tile-Setting Epoxy and Water Cleanable Tile-Setting and Grouting Epoxy Adhesive
- A118.4-05 ..... Latex-Portland Cement Mortar
- A118.6-05 ..... Standard Cement Grouts for Tile Installation
- A118.9-05 ..... Cementitious Backer Units
- A118.10-05 ..... Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation
- A136.1-05 ..... Organic Adhesives for Installation of Ceramic Tile
- A137.1-88 ..... Ceramic Tile
- C. American Society For Testing And Materials (ASTM):
- C109/C109M-07 ..... Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or [50-mm] Cube Specimens)
- C348-02 ..... Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
- C1002-07 ..... Steel Self-Piercing Tapping Screws for the Application of Panel Products
- C1027-99(R2004) ..... Determining "Visible Abrasion Resistance on Glazed Ceramic Tile"
- D. Tile Council of America, Inc. (TCA):
- 2007 ..... Handbook for Ceramic Tile Installation

**PART 2 - PRODUCTS**

**2.1 TILE**

- A. Comply with ANSI A137.1, Standard Grade, except as modified:
1. Inspection procedures listed under the Appendix of ANSI A137.1.
  2. Slip Resistant Tile for Floors:
    - a. Coefficient of friction, when tested in accordance with ASTM C1028, required for level of performance:
      - 1) Not less than 0.7 (wet condition) for bathing areas.
      - 2) Not less than 0.8 on ramps for wet and dry conditions.



**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

**2.1 TILE (CONT)**

- 3) Not less than 0.6, except 0.8 on ramps as stated above, for wet and dry conditions for other areas.
- b. Tile Having Abrasive Grains:
  1. Unglazed Ceramic Mosaic Tile: Abrasive grains throughout body of the tile.
- c. Porcelain Paver Tile: Matte surface finish
3. Do not use back mounted tiles in showers
4. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
5. Factory-Applied Temporary Protective Coating:
  - a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
  - b. Do not coat unexposed tile surfaces.
  - c. Pre-wax tiles set or grouted with epoxy mortars.
- B. Glazed Wall Tile: Cushion edges, glazing, as specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Porcelain Paver Tile: Nominal 8 mm (5/16 inch) thick, with cushion edges. Porcelain tile produced by the dust pressed method shall be made of approximately 50% feldspar; the remaining 50% shall be made up of various high-quality light firing ball clays yielding a tile with a water absorption rate of 0.5% or less and a breaking strength of between 390 to 400 pounds.
- D. Trim Shapes:
  1. Conform to applicable requirements of adjoining floor and wall tile.
  2. Use slip resistant trim shapes for horizontal surfaces of showers , shower curbs, drying area curbs,
  3. Use trim shapes sizes conforming to size of adjoining field wall tile unless detailed or specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
  4. Internal and External Corners:
    - a. Square internal and external corner joints are not acceptable.
    - b. External corners including edges: Use bullnose shapes.
    - c. Internal corners: Use cove shapes.
    - d. Base to floor internal corners: Use special shapes providing integral cove vertical and horizontal joint.
    - e. Base to floor external corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.
    - f. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.
    - g. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.
    - h. For unglazed ceramic mosaic and glazed wall tile installed in Portland cement mortar setting bed, use cove and bullnose shapes as applicable. When ceramic mosaic wall and base tile is required, use C Series cove and bullnose shapes.

**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

- i. For unglazed ceramic mosaic and glazed wall tile installed in dry-set Portland cement mortar, latex-Portland cement mortar, and organic adhesive (thin set methods), use cove and surface bullnose shapes as applicable.
- k. Provide cove and bullnose shapes where shown, and required to complete tile work.

**2.2 CEMENTITIOUS BACKER UNITS**

- A. Use in showers or wet areas.
- B. ANSI A118.9.
- C. Use Cementitious backer units in maximum available lengths.
- D. Backer unit meet or exceed the following additional physical properties:

<u>Property</u>	<u>Test Method</u>	<u>Value</u>
Water absorption	ASTM C948	Less than 20 percent by weight

**2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS**

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-Portland cement mortar complying with ANSI A118.4.
- C. Joint material, including reinforcing tape, and tape embedding material, shall be as specifically recommended by the backer unit manufacturer.

**2.4 FASTENERS**

- A. Screws for Cementitious Backer Units.
  - 1. Standard screws for gypsum board are not acceptable.
  - 2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
  - 3. ASTM C954 for steel 1 mm (0.033 inch) thick.
  - 4. ASTM C1002 for steel framing less than 0.0329 inch thick.
- B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

**2.6 SETTING MATERIALS OR BOND COATS**

- A. Conform to TCA Handbook for Ceramic Tile Installation.
- B. Portland Cement Mortar: ANSI A108.1.
- C. Dry-Set Portland Cement Mortar: ANSI A118.1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A118.4.
- D. Organic Adhesives: ANSI A136.1, Type 1.
- E. Chemical-Resistant Bond Coat:
  - 1. Epoxy Resin Type: ANSI A118.3.
  - 2. Furan Resin Type: ANSI A118.5.
- F. Elastomeric Waterproofing Membrane and Bond Coat:
  - 1. TCA F122-02.
  - 2. ANSI A118.10.
  - 3. One component polyurethane, liquid applied material having the following additional physical properties:
    - a. Hardness: Shore "A" between 40-60.

**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

**2.6 SETTING MATERIALS OR BOND COATS (CONT)**

- b. Elongation: Between 300-600 percent.
- c. Tensile strength: Between 40-60 psig.
- d. No volatile compounds.
- 4. Coal tar modified urethanes are not acceptable.

**2.7 GROUTING MATERIALS**

- A. Coloring Pigments:
  - 1. Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
  - 2. Add coloring pigments to grout by the manufacturer.
  - 3. Job colored grout is not acceptable.
  - 4. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout
- B. Latex-Portland Cement Grout: ANSI A118.6 color as specified.
  - 1. Unsanded grout mixture for joints 3.2 mm (1/8 inch) and narrower.
  - 2. Sanded grout mixture for joints 3.2 mm (1/8 inch) and wider.
- C. Chemical-Resistant Grout:
  - 1. Epoxy grout, ANSI A118.3.
  - 2. Furan grout, ANSI A118.5.

**2.8 PATCHING AND LEVELING COMPOUND**

- A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Shall have minimum following physical properties:
  - 1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
  - 2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
  - 3. Tensile strength - 600 psi per ANSI 118.7.
  - 4. Density - 1.9.
- C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 100 mm (four inches) thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.
- D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.
- E. Ready for use in 48 hours after application.

**2.10 METAL DIVIDER STRIPS**

- A. Terrazzo type divider strips.
- B. Heavy top type strip with 5 mm (3/16 inch) wide top and 38 mm (1-1/2 inch) long leg.
- C. Embedded leg perforated and deformed for keying to mortar.
- D. Aluminum or brass as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

**2.11 WATER**

Clean, potable and free from salts and other injurious elements to mortar and grout materials.

**2.12 CLEANING COMPOUNDS**

- A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- B. Materials containing acid or caustic material not acceptable.

**PART 3 - EXECUTION**

**3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain ambient temperature of work areas at not less than 16 degree C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three days after installation.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.
- C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).
- D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).
- E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after fourth day of completion of tile work.

**3.2 ALLOWABLE TOLERANCE**

- A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
  - 1. Not more than 1 in 500 (1/4 inch in 10 feet) from required elevation where Portland cement mortar setting bed is used.
  - 2. Not more than 1 in 1000 (1/8 inch in 10 feet) where dry-set Portland cement, and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.
- B. Variation in Plane of Wall Surfaces:
  - 1. Not more than 1 in 400 (1/4 inch in eight feet) from required plane where Portland cement mortar setting bed is used.
  - 2. Not more than 1 in 800 (1/8 inch in eight feet) where dry-set or latex-Portland cement mortar or organic adhesive setting materials is used.

**3.3 SURFACE PREPARATION**

- A. Cleaning New Concrete:
  - 1. Chip out loose material, clean off all oil, grease dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical method, or by using products specifically designed for cleaning concrete and masonry.

**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

**3.3 SURFACE PREPARATION (CONT)**

- B. Patching and Leveling:
  - 1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
  - 2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
    - a. Thickness of compound as required to bring finish tile system to elevation shown.
    - b. Float finish except finish smooth for elastomeric waterproofing.
    - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
  - 3. Apply patching and leveling compound to concrete surfaces that are out of required plane.
  - 4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
- C. Mortar Bed for Slopes to Drains:
  - 1. Slope compound to drain where drains are shown.
  - 2. Install mortar bed in depressed slab sloped to drains not less than 1 in 200 (1/16 inch per foot).
  - 3. Allow not less than 50 mm (2 inch) depression at edge of depressed slab.
  - 4. Screed for slope to drain and float finish.
  - 5. Cure mortar bed for not less than seven days. Do not use curing compounds or coatings.
- D. Additional preparation of concrete floors for tile set with epoxy, shall be in accordance with the manufacturer's printed instructions.

**3.4 CEMENTITIOUS BACKER UNITS**

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A108.11 except as specified otherwise.
- C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a V joint for joint treatment.
- D. Secure cementitious backer units to each framing member with screws spaced not more than 200 mm (eight inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.
- E. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top one-inch of turned up waterproof systems.
- F. Do not install joint treatment for seven days after installation of cementitious backer unit.

**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

**3.4 CEMENTITIOUS BACKER UNITS**

G. Joint Treatment:

1. Fill horizontal and vertical joints and corners with latex-Portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.

**3.7 METAL DIVIDER STRIPS**

- A. Install metal divider strips in floor joints between ceramic tile floors and between tile floors and adjacent flooring of other materials where the finish floors are flush unless shown otherwise.
- B. Set divider strip in mortar bed to line and level centered under doors or in openings.

**3.8 CERAMIC TILE - GENERAL**

- A. Comply with ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" applicable to methods of installation.
- B. Comply with TCA Installation Guidelines:
- C. Installing Mortar Beds for Floors:
  1. Install mortar bed to not damage waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.
  2. Screed finish to level plane or slope to drains where shown, float finish.
- D. Setting Beds or Bond Coats:

System W211-02, W221-02 or W222-02.

  1. Set wall tile installed over concrete backer board in latex-Portland cement mortar, ANSI A108.1B.
  2. Set trim shapes in same material specified for setting adjoining tile.
- E. Workmanship:
  1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field. // Align new tile work scheduled for existing spaces to the existing tile work unless specified otherwise. //
  2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise.
  3. Form intersections and returns accurately.
  4. Cut and drill tile neatly without marring surface.
  5. Cut edges of tile abutting penetrations, finish, or built-in items:
    - a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
    - b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
  6. Completed work shall be free from hollow sounding areas and loose, cracked or defective tile.
  7. Remove and reset tiles that are out of plane or misaligned.

**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

**3.8 CERAMIC TILE - GENERAL (CONT)**

8. Floors:
  - a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
  - b. Align finish surface of new tile work flush with other and existing adjoining floor finish where shown.
  - c. In areas where floor drains occur, slope to drains where shown.
  - d. Shove and vibrate tiles over 200 mm (8 inches) square to achieve full support of bond coat.
9. Walls:
  - a. Cover walls and partitions, including pilasters, furred areas, from floor to ceiling, or from floor to nominal wainscot heights shown with tile.
  - b. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
10. Joints:
  - a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
  - b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
  - c. Make joints in Paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.
11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
  - a. Tile wall installations in wet areas, including showers, tub enclosures, laundries and swimming pools.
  - b. Tile installed with chemical-resistant mortars and grouts.
  - c. Tile wall installations composed of tiles 200 by 200 mm (8 by 8 inches or larger).
  - d. Exterior tile wall installations.

**3.9 CERAMIC TILE INSTALLED WITH PORTLAND CEMENT MORTAR**

- A. Mortar Mixes for Floor, Wall And Base Tile (including Showers,): ANSI A108.1, except specified otherwise.
- B. Installing Wall and Base Tile: ANSI A108.1, except specified otherwise.
- C. Installing Floor Tile: ANSI A108.1, except as specified otherwise. Slope mortar beds to floor drains a minimum of 1 in 100 (1/8 inch per foot).

**3.10 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR**

- A. Installation of Tile: ANSI A108.5, except as specified otherwise.
- B. Slope tile work to drains not less than 1 in 100 (1/8 inch per foot).

**3.11 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH ORGANIC ADHESIVE**

Installation of Tile: ANSI A108.4.

**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

**3.13 GROUTING**

- A. Grout Type and Location:
  - 1. Grout for glazed wall and base tile, paver tile and unglazed mosaic tile Portland cement grout, latex-Portland cement grout, dry-set grout, or commercial Portland cement grout.
  - b. Grout for Kitchens:
    - a) Epoxy grout designed for equivalent heat resistance to furan resin grout may be used for furan resin grout.
- B. Workmanship:
  - 1. Install and cure grout in accordance with the applicable standard.
  - 2. Portland Cement grout: ANSI A108.10.
  - 3. Epoxy Grout: ANSI A108.6.
  - 4. Furan and Commercial Portland Cement Grout: ANSI A108.8 and in accordance with the manufacturer's printed instructions.
  - 5. Dry-set grout: ANSI A108.5.

**3.16 MOVEMENT JOINTS**

- A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.
- B. TCA details EJ 171-02.
- C. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.
- D. Rake out grout at joints between tile, at toe of base, and where shown not less than 6 mm (1/4 inch) deep.

**3.17 CLEANING**

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used shall not damage or impair appearance of tile surfaces.
- C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- D. Clean tile grouted with epoxy, furan and commercial Portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

**3.18 PROTECTION**

- A. Keep traffic off tile floor, until grout and setting material is firmly set and cured.
- B. Where traffic occurs over tile floor, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

**3.19 TESTING FINISH FLOOR**

- A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.
- B. Test kitchen and storage rooms.

- - - E N D - - -



**SECTION 09 51 00**  
**ACOUSTICAL CEILINGS**

**1.1 DESCRIPTION**

- A. Metal ceiling suspension system for acoustical ceilings.
- B. Acoustical units.
- C. Adhesive application.

**1.2 RELATED WORK**

- A. Color, pattern, and location of each type of acoustical unit:  
Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTAL**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Ceiling suspension system, each type, showing complete details of installation, including suspension system specified to match existing and upward access system details for concealed grid systems.
  - 2. Acoustical units, each type
  - 3. Runners designed for snap-in attachment of metal pans
- C. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

**1.4 DEFINITIONS**

- A. Standard definitions as defined in ASTM C634.
- B. Terminology as defined in ASTM E1264.

**1.5 EXTRA STOCK**

- A. Provide minimum 2 cartons of each ceiling tile type for Owner stock.

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A641/ A641M-03.....Zinc-coated (Galvanized) Carbon Steel Wire
  - A653/ A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process
  - C423-07 .....Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - C634-02 (E2007) .....Standard Terminology Relating to Environmental Acoustics
  - C635-04 .....Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
  - C636-06 .....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
  - E84-07.....Surface Burning Characteristics of Building Materials
  - E119-07.....Fire Tests of Building Construction and Materials
  - E413-04.....Classification for Rating Sound Insulation.

**SECTION 09 51 00**  
**ACOUSTICAL CEILINGS**

**1.6 APPLICABLE PUBLICATIONS (CONT)**

- E580-06.....Application of Ceiling Suspension Systems for Acoustical Tile  
and Lay-in Panels in Areas Requiring Seismic Restraint  
E1264-(R2005) .....Classification for Acoustical Ceiling Products

**PART 2- PRODUCTS**

**2.1 METAL SUSPENSION SYSTEM**

- A. ASTM C635, heavy-duty system, except as otherwise specified.
  - 1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
    - a. Galvanized cold-rolled steel, bonderized.
    - b. Extruded aluminum.
  - 2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
  - 3. Use aluminum suspension in kitchens and aluminum in toilets adjacent to shower areas.
- B. Exposed grid suspension system for support of lay-in panels:
  - 1. Exposed grid width not less than 15/16 inch with not less than 8 mm (5/16 inch) panel bearing surface.
  - 2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
  - 3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.

**2.2 PERIMETER SEAL**

- A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
- B. Thickness as required to fill voids between back of wall molding and finish wall.
- C. Not less than 9 mm (3/8 inch) wide strip.

**2.3 WIRE**

- A. ASTM A641.
- B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).
- C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

**2.4 ANCHORS AND INSERTS**

- A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.
- B. Hanger Inserts:
  - 1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).

**SECTION 09 51 00  
ACOUSTICAL CEILINGS**

**2.4 ANCHORS AND INSERTS (CONT)**

2. Flush ceiling insert type:
  - a. Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
  - b. Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
  - c. Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.
- C. Clips:
  1. Galvanized steel.
  2. Designed to clamp to steel beam or bar joists, or secure framing member together.
  3. Designed to rigidly secure framing members together.
- D. Tile Splines: ASTM C635.
- E. Hold down clips:
  1. Provide at all ceiling tiles.

**2.5 CARRYING CHANNELS FOR SECONDARY FRAMING**

- A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.
- B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

**2.6 ACOUSTICAL UNITS**

- A. General:
  1. Ceiling Tile shall meet minimum 37% bio-based content in accordance with USDA Bio-Preferred Product requirements.
  2. ASTM E1264, weighing 3.6 kg/m<sup>2</sup> (3/4 psf) minimum for mineral fiber panels or tile.
  3. Class A Flame Spread: ASTM E 84 Flame spread index 25 or less, smoke development index 50 or less
  4. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
  5. Minimum CAC (Ceiling Attenuation Class): 40-44 range unless specified otherwise: ASTM E413.
  6. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces, except as specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
  7. Lay-in panels: Sizes as shown, with types of edges .
- B. **Type AT(SP) Units** - Ceramic and Mineral base with factory applied plastic paint finish , scrubbable , minimum 16 mm (5/8 inch) thick. Sag resistant in high humidity, anti-mold/mildew & bacteria resistant. ASTM E1264, square Lay-in, 24x48 inches. NRC=.55. Design Basis: Section 09 06 00, SCHEDULE FOR FINISHES.

**SECTION 09 51 00**  
**ACOUSTICAL CEILINGS**

- C. **Type AT1 Units** - Fiberglass with acoustically transparent membrane with factory applied latex paint, minimum 25mm (1inch) thick. Sag resistant in high humidity, anti-mold/mildew & bacteria resistant. ASTM E1264, square Lay-in, 24x24 and 48x48 inches. NRC=.90 minimum. Design Basis: Section 09 06 00, SCHEDULE FOR FINISHES
- B. **Type AT2 Units** - Wet formed mineral fiber with factory applied latex paint, 19mm (3/4 inch) thick. , anti-mold/mildew & bacteria resistant. ASTM E1264, beveled tegular, 24x48 inches. NRC=.65 Design Basis: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. **Type AT3 Units** - Wet formed mineral fiber with factory applied latex paint, 19mm (3/4 inch) thick. , anti-mold/mildew & bacteria resistant. ASTM E1264, beveled tegular, 24x48 inches. NRC=.65 Design Basis: Section 09 06 00, SCHEDULE FOR FINISHES

**2.7 ACCESS IDENTIFICATION**

- A. Markers:
  - 1. Use colored markers with pressure sensitive adhesive on one side.
  - 2. Make colored markers of paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.
- B. Use markers of the same diameter throughout building.
- C. Color Code: Use following color markers for service identification:

Color .....	Service
Red .....	Sprinkler System: Valves and Controls
Green.....	Domestic Water: Valves and Controls
Yellow .....	Chilled Water and Heating Water
Orange .....	Ductwork: Fire Dampers
Blue .....	Ductwork: Dampers and Controls
Black.....	Gas: Laboratory, Medical, Air and Vacuum

**PART 3 EXECUTION**

**3.1 CEILING TREATMENT**

- A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.
- B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.
- C. Moldings:
  - 1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
  - 2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.
- D. Perimeter Seal:
  - 1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
  - 2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.

**SECTION 09 51 00**  
**ACOUSTICAL CEILINGS**

**3.2 CEILING SUSPENSION SYSTEM INSTALLATION**

**A. General:**

1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
3. Support a maximum area of 1.48 m<sup>2</sup> (16 sf) of ceiling per hanger.
4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
6. Provide not less than 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
7. Use main runners not less than 1200 mm (48 inches) in length.
8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

**B. Anchorage to Structure:**

**1. Steel:**

- a. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels for attachment of hanger wires.
  - (1) Size and space carrying channels to insure that the maximum deflection specified will not be exceeded.
  - (2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
- b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fire proofing is installed. Weld or use steel clips to attach to beam to develop full strength of carrying channel.
- c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.

**B. Direct Hung Suspension System:**

1. As illustrated in ASTM C635.
2. Support main runners by hanger wires attached directly to the structure overhead.
3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

**C. Indirect Hung Suspension System:**

1. As illustrated in ASTM C635.
2. Space carrying channels for indirect hung suspension system not more than 1200 mm (4 feet) on center. Space hangers for carrying channels not more than 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) on center so as to insure that specified requirements are not exceeded.
3. Support main runners by specially designed clips attached to carrying channels.

**D. Seismic Ceiling Bracing System:**

1. Construct system in accordance with ASTM E580.

**SECTION 09 51 00  
ACOUSTICAL CEILINGS**

**3.2 CEILING SUSPENSION SYSTEM INSTALLATION (CONT)**

2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels of suspended ceiling at bottom.

**3.3 ACOUSTICAL UNIT INSTALLATION**

- A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.
  1. Install tile to lay level and in full contact with exposed grid.
  2. Replace cracked, broken, stained, dirty, or tile not cut for minimum bearing.
  3. Install hold down clips to secure tile.
- C. Markers:
  1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems.
  2. Attach colored markers to exposed grid on opposite sides of the units providing access.
  3. Attach marker on exposed ceiling surface of upward access acoustical unit.

**3.4 CLEAN-UP AND COMPLETION**

- A. Replace damaged, discolored, dirty, cracked and broken acoustical units.
- B. Leave finished work free from defects.

- - - E N D - - -

**SECTION 09 51 30**  
**SUSPENDED WOOD SLAT CEILING SYSTEM**

**PA RT 1 - GENERAL**

**1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Finish Carpentry: Section 06220
- B. Suspended Acoustic Ceilings: Section 09500

**1.2 REFERENCED SPECIFICATIONS**

- A. Suspension System:
  - 1. Refer to "Metal Suspension system for Acoustic Tile and Lay-in Panel Ceilings", ASTM C-635; and to "Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustic Tile and Lay-in Panels", ASTM C-636.
- B. Wood Slats:
  - 2. Refer to material and workmanship standards published in "Architectural Woodwork Quality Standards", 1993 edition; as published by Architectural Woodwork Institute, hereinafter referred to as AWI; Box 1550; Centreville, VA 22020; (703) 222-1100.

**1.3 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.4 SHOP DRAWINGS**

- A. Submit in accordance with Section 01330.
- B. Include Reflected Ceiling Plan, Slat profiles, Joint details, Trim, Slat species and finish, Suspension System, Opening treatment, connections to adjacent Work, and other pertinent data, whether or not Materials are furnished by this Contractor.

**1.5 SAMPLES**

- A. Submit in accordance with Section 01330.
- B. Include six 24 inch long Slat samples showing Slat size, shape, and color range.

**1.6 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Manufacturer of Products being installed.

**1.7 REGULATORY AGENCY REQUIREMENTS**

- A. Measure Flame-spread in accordance with ASTM E-84.

**1.8 FIELD MOCK-UP**

- A. Prepare in accordance with Section 01330.
- B. Include sample Mock-up of Ceiling System, including Suspension System, and any Lighting Fixtures, Mechanical Grilles, or other openings through System.

**1.9 PRODUCT DELIVERY**

- A. Do not deliver Wood Products to Jobsite until notified by General Contractor that Project is conditioned and prepared to handle and store Products without damage and discoloration.

**SECTION 09 51 30**  
**SUSPENDED WOOD SLAT CEILING SYSTEM**

**1.10 PRODUCT STORAGE & HANDLING**

- A. Protect against damage and discoloration.

**1.11 ENVIRONMENTAL REQUIREMENTS**

- A. Delay System installation until Work Spaces are sufficiently dry to prevent Wood Slats from absorbing Moisture.
- B. Perform Work only under the following minimum Work Space Air Temperatures:
  - 1. For 24 hours prior to and during installation: 50° F
  - 2. Thereafter: Match Owner's-use temperature.

**1.12 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 SUSPENSION SYSTEM**

- A. Type: Tee Bar
- B. Material: Steel
- C. Color: Black

**2.2 ATTACHMENT CLIPS**

- A. Material: Stainless Steel
- B. Size & Model: Satisfy conditions of use.
- C. Type: Permit Slat removal at any time after installation.
- D. Quantity: Provide all required.

**2.3 WOOD SLATS (LWC1)**

- A. Style: Panelized Linear Wood
- B. Species: Alder
- C. Maximum Moisture Content at Installation Time: 12%
- D. Thickness: 5/8 inch
- E. Face Width: 3-1/4 inches
- F. AWI Grade: Premium
  - 1. Face Grain: Vertical
  - 2. Surface Texture: Smooth
  - 3. Joint Pattern: Open
- G. Length: One-piece single length 6 ft. minimum
- H. Shop Finish: Standard Stain, color to be determined
- I. Required Accessories: Secure to backside of each Slat 1-1/2 inch wide, 1/16 inch thick, black Fiber Strip to cover Joints between Slats.
- J. Maximum Allowable Tolerances for individual Slats:
  - 1. Crook: 1/4 inch per 8 ft.
  - 2. Warp: 1/4 inch per 8 ft.
  - 3. Twist: 1/8 inch per 8 ft.



**SECTION 09 51 30**  
**SUSPENDED WOOD SLAT CEILING SYSTEM**

**2.3 WOOD SLATS (LWC1) (Cont)**

- K. Design Basis: 9Wood Inc 2100 Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES

**2.4 WOOD SLATS (LWC2)**

- A. Style: Acoustic Plank Wood
- B. Species: Alder
- C. Maximum Moisture Content at Installation Time: 12%
- D. Thickness: 5/8 inch
- E. Face Width: 7-9/16 inches with 1/6" grooves at 5/8" o.c.
- F. AWI Grade: Premium
  - 1. Face Grain: Vertical
  - 2. Surface Texture: Smooth
  - 3. Joint Pattern: Open
- G. Length: One-piece single length 6 ft. minimum
- H. Shop Finish: Standard Stain, color to be determined
- I. Required Accessories: Secure to backside of each Slat 1-1/2 inch wide, 1/16 inch thick, black Fiber Strip to cover Joints between Slats.
- J. Maximum Allowable Tolerances for individual Slats:
  - 1. Crook: 1/4 inch per 8 ft.
  - 2. Warp: 1/4 inch per 8 ft.
  - 3. Twist: 1/8 inch per 8 ft.
  - 4. Design Basis: 9Wood Inc 3100 Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

**2.5 ACOUSTIC BATTS**

- A. Material: Glass fiber, black faced, semi-rigid
- B. Thickness: 2 inch.
- C. Widths: 24" and 48"
- D. Minimum Noise Reduction Coefficient Rating: 1.0

**2.6 FASTENERS & ACCESSORIES**

- A. Type & Size: Recommended by System Manufacturer.
- B. Extent of Work: Provide all required to complete System.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Structure and Surfaces to receive System are complete, dry and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**SECTION 09 51 30**  
**SUSPENDED WOOD SLAT CEILING SYSTEM**

**PART 3 - EXECUTION**

**3.3 INSTALLATION**

- A. Suspension System:
- B. Follow Referenced Specifications.
  - 1. Where Mechanical and Electrical Work interferes with regular spacing of Hangers, provide additional Hangers and Channels and make necessary adjustments in Ceiling construction.
  - 2. Do not attach to or pass Hangers through Mechanical or Electrical Ductwork.
  - 3. Provide Framing around any recessed Lighting Fixtures and other Openings.
- C. Maximum Vertical Hanger Splay: 6 inches per 4 ft.
- D. Fabricate System to any curves or shapes shown on Drawings.
- E. Wood Slats:
  - 1. Follow System Manufacturer's instructions.
  - 2. Delay work until any adjacent Painting or Finishing is completed.
  - 3. Secure each Slat to Suspension System.
  - 4. Install level, flush, in straight line courses, with uniform spaces between Slats, and in accord with layout shown on Drawings.
  - 5. Neatly cut around and trim Openings.
  - 6. Stagger any Butt Joints between adjacent Slats at least 12 inches and make Joints flush.
- F. Acoustic Batts:
  - 1. Install over top side of Slats.
  - 2. Butt Batts tightly together allowing no voids for Sound passage.

**3.4 ALLOWABLE INSTALLATION TOLERANCES**

- A. Maximum fully loaded Ceiling Deflection in accordance with ASTM C-635: 1/360 of Span.
- B. Install Finish Surfaces level and true within 1/8 inch per 12 ft.

**3.5 WASTE MANGEMENT**

- A. In accordance with Waste Management Plan specified in Section 01640:
  - 1. Collect Metal Cut-offs, Wood Scraps, and Packaging; and place where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- A. Including Work of other Trades, clean, repair and touch-up, or replace when directed, Products which have been soiled, discolored, or damaged by Work of this Section.
- B. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**SECTION 09 65 13**  
**RESILIENT BASE AND ACCESSORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the installation of vinyl or rubber base and resilient stair treads with sheet rubber flooring on landings.

**1.2 RELATED WORK**

- A. Color and texture: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Integral base with sheet flooring: Section 09 65 16, RESILIENT SHEET FLOORING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Samples:
  - 1. Base: 150 mm (6 inches) long, each type and color.
  - 2. Adhesive: Literature indicating each type.

**1.4 DELIVERY**

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

**1.5 STORAGE**

- A. Store materials in weather tight and dry storage facility.
- B. Protect material from damage by handling and construction operations before, during, and after installation.

**1.6 EXTRA STOCK**

- A. Provide a minimum of 10 lineal feet of each type and color of rubber base.

**1.7 APPLICABLE PUBLICATIONS**

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - F1344-10..... Rubber Floor Tile
  - F1859-10..... Rubber Sheet Floor Covering without Backing
  - F1860-10..... Rubber Sheet Floor Covering with Backing
  - F1861-08..... Resilient Wall Base

**SECTION 09 65 13**  
**RESILIENT BASE AND ACCESSORIES**

**PART 2 - PRODUCTS**

**2.1 GENERAL**

Use only products by the same manufacturer and from the same production run.

**2.2 RESILIENT BASE**

- A. ASTM F1861, 3 mm (1/8 inch) thick, Thermoplastics, Group 2-layered. Style B-cove.
  - 1. RB-2: 100 mm (4 inches) high.
  - 2. RB-1 150 mm (6 inches) high

**2.3 ADHESIVES**

- A. Use products recommended by the material manufacturer for the conditions of use.
- B. Use low-VOC adhesive during installation. Water based adhesive with low VOC is preferred over solvent based adhesive.

**PART 3 - EXECUTION**

**3.1 PROJECT CONDITIONS**

- A. Maintain temperature of materials above 65 °F, for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs, between 21° C and 27° C (70°F and 80°F) for at least 48 hours, before, during, and after installation.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

**3.2 INSTALLATION REQUIREMENTS**

- A. The respective manufacturer's instructions for application and installation will be considered for use when approved by the Resident Engineer.
- B. Submit proposed installation deviation from this specification to the Resident Engineer indicating the differences in the method of installation.
- C. The Resident Engineer reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

**3.3 PREPARATION**

- A. Examine surfaces on which material is to be installed.
- B. Fill cracks, pits, and dents with leveling compound.
- D. Do not use adhesive for leveling or filling.
- E. Grind, sand, or cut away protrusions; grind high spots.
- F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.
- G. Substrate area dry and cured. Perform manufacturer's recommended bond and moisture test.

**SECTION 09 65 13**  
**RESILIENT BASE AND ACCESSORIES**

**3.4 BASE INSTALLATION**

- A. Location:
  - 1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, pharmacy furniture island cabinets and where other equipment occurs.
  - 2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.
- B. Application:
  - 1. Apply adhesive uniformly with no bare spots.
  - 2. Set base with joints aligned and butted to touch for entire height.
  - 3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 1200mm (48 inches) length.
    - a. Short pieces to save material will not be permitted.
    - b. Locate joints remote from corners as the material or the wall configuration will permit.
- C. Form corners and end stops as follows:
  - 1. Score back of outside corner.
  - 2. Score face of inside corner and notch cove.
- D. Roll base for complete adhesion.

**3.5 CLEANING AND PROTECTION**

- A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.
- B. Keep traffic off resilient material for at least 72 hours after installation.
- C. Clean and polish materials in the following order:
  - 1. After two weeks, scrub resilient base, sheet linoleum with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue
  - 2. Wipe base dry with clean cloth to eliminate water spots.
  - 3. Do not polish sheet linoleum materials.
- D. When construction traffic is anticipated, cover tread materials with reinforced kraft paper and plywood or hardboard properly secured and maintained until removal is directed by the Resident Engineer.
- E. Where protective materials are removed and immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

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**SECTION 09 65 16**  
**RESILIENT SHEET FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Installation of sheet flooring including following:
  - 1. Heat welded seams.
  - 2. Integral cove base: Installed at intersection of floor and vertical surfaces.

**1.2 RELATED WORK**

- A. Concrete floors: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Color, pattern and texture: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Resilient base over base of lockers, equipment and casework: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

**1.3 QUALITY CONTROL-QUALIFICATIONS:**

- A. The Contracting Officer shall approve products or service of proposed manufacturer, suppliers, and installers, and the Contractor shall submit certification that:
  - 1. Heat welded seaming is manufacturer's prescribed method of installation.
  - 2. Installer is approved by manufacturer of materials and has technical qualifications, experience, trained personnel, and facilities to install specified items.
    - a. Provide project contact phone numbers for verification.
  - 3. Manufacturer's product submitted has been in satisfactory operation, on three installations similar and equivalent in size to this project for three years. Submit list of installations.
- B. The sheet vinyl floor coverings shall meet fire performance characteristics as determined by testing products, per ASTM test method, indicated below by Underwriters Laboratories, Inc. (UL) or another recognized testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
  - 2. Smoke Density: Less than 450 per ASTM E662.
- C. The floor covering manufacturer shall certify that products supplied for installation comply with local regulations controlling use of volatile organic compounds (VOC's).

**1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, submit following:
- B. Manufacturer's Literature and Data:
  - 1. Description of resilient material and accessories to be provided.
  - 2. Resilient material manufacturer's recommendations for adhesives, weld rods, sealants, and underlayment.
  - 3. Application and installation instructions.
- C. Samples:
  - 1. Sheet material, 150 mm by 300 mm (6 inch by 12 inch), of each color and pattern with a welded seam using proposed welding

**SECTION 09 65 16  
RESILIENT SHEET FLOORING**

**1.4 SUBMITTALS (CONT)**

2. Shop Drawings and Certificates: Layout of joints showing patterns where joints are expressed, and type and location of obscure type joints. Indicate orientation of directional patterns.
3. Edge strips, fillet strips and cap strips: 150 mm (6 inches) long each type.
4. Adhesive, underlayment and primer: Pint container, each type.

**1.5 PROJECT CONDITIONS**

- A. Maintain temperature of floor materials and room, where work occurs, above 18 ° C (65 °F) and below 38 ° C (100 °F) for 48 hours before, during and for 48 hours after installation. After above period, room temperature shall not fall below 13 ° C (55 °F).
- B. Construction in or near areas to receive flooring work shall be complete, dry and cured. Do not install resilient flooring over slabs until they have been cured and are sufficiently dry to achieve a bond with adhesive. Follow flooring manufacturer's recommendations for bond and moisture testing.
- C. Building shall be permanently enclosed. Schedule construction so that floor receives no construction traffic when completed.

**1.6 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials to site in original sealed packages or containers; labeled for identification with manufacturer's name and brand.
- B. Deliver sheet flooring full width roll, completely enclosed in factory wrap, clearly marked with the manufacturer's number, type and color, production run number and manufacture date.
- C. Store sheet flooring on end.
- D. Move sheet vinyl floor coverings and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

**1.7 EXTRA STOCK**

- A. Provide roll width x 8 feet plus any scraps larger than 2ft square for Owner repairs

**1.8 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society For Testing Materials (ASTM):
  - E648-09..... Critical Radiant Flux of Floor-Covering Systems Using a Radiant Energy Source.
  - E662-09..... Specific Optical Density of Smoke Generated by Solid Materials.
  - F710-08..... Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.
  - F1303-04..... Sheet Vinyl Floor Covering with Backing.
  - F2170-09 ..... Determining Relative Humidity in Concrete Floor Slabs using In-situ Probes



**SECTION 09 65 16**  
**RESILIENT SHEET FLOORING**

**1.8 SCHEDULING**

Interior finish work such as drywall finishing, concrete, terrazzo, ceiling work, and painting work shall be complete and dry before installation. Mechanical, electrical, and other work above ceiling line shall be completed. Heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

**1.9 WARRANTY:**

Submit written warranty, in accordance with FAR clause 52.246-21, Warranty of Construction requirements except that warranty period shall be extended to include two (2) years.

**PART 2 - PRODUCTS**

**2.1 WELDED SEAM SHEET LINOLEUM FLOOR COVERINGS (LN-S1)**

- A. Sheet Linoleum Floor Coverings: Smooth face, minimum thickness nominal 2 mm (0.08 inch). Sheet flooring shall conform to ASTM F2034, homogeneous floor covering made of linseed oil, wood flour, limestone, dry pigments mixed and calendared onto a jute backing with a polyolefin comfort layer.
- B. Size: Provide maximum size sheet vinyl material produced by manufacturer to provide minimum number of joints. Minimum size width acceptable - 2 m (79 inches) x 3.5mm (0.137 inch) gage,
- C. Each color and pattern of sheet flooring shall be of same production run.
- D. Bacterial resistant.
- E. Impact Sound Reducer: 17db when test in accordance with ISO 20717-2 IIC 60.
- F. Chemical Resistant: ASTM F 95
- G. Design Basis: Forbo Marmoleum see Section 09 06 00, SCHEDULE FOR FINISHES.

**2.2 WELDING ROD:**

Product of floor covering manufacturer in color shall match specified color of Specification legend. If no color selected, submit 3 colors of each product proposed for Designer selection.

**2.3 APPLICATION MATERIALS AND ACCESSORIES**

- A. Floor and Base Adhesive: Type recommended by sheet flooring material manufacturer for conditions of use.
- B. Mastic Underlayment (for concrete floors): Provide products with latex or polyvinyl acetate resins in mix. Condition to be corrected shall determine type of underlayment selected for use and recommended by manufacturer.
- C. Base Accessories:
  - 1. Fillet Strip: 19 mm (3/4 inch) radius fillet strip compatible with resilient sheet material.
  - 2. Cap Strip: Extruded flanged zero edge vinyl reducer strip approximately 25 mm (one inch) exposed height with 13 mm (1/2 inch) flange.

**SECTION 09 65 16**  
**RESILIENT SHEET FLOORING**

**2.4 ADHESIVES**

Water resistant type recommended by the sheet flooring manufacturer for the conditions of use. VOC not to exceed 50g/L

**2.5 COVE**

- A. Cove : 4 inch high

**2.7 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

Provide cementitious products with latex or polyvinyl acetate resins in the mix.

**2.8 PRIMER (FOR CONCRETE SUBFLOORS)**

As recommended by the adhesive or sheet flooring manufacturer.

**2.9 EDGE STRIPS**

- A. Extruded aluminum, mill finish, mechanically cleaned.
- B. 28 mm (1-1/8 inch) wide, 6 mm (1/4 inch) thick, bevel one edge to 3 mm (1/8 inch) thick.
- C. Drill and counter sink edge strips for flat head screws. Space holes near ends and approximately 225 mm (9 inches) on center in between.

**2.10 SEALANT**

- A. As specified in Section 07 92 00, JOINT SEALANTS.
- B. Compatible with sheet flooring.

**PART 3 - EXECUTION**

**3.1 PROJECT CONDITIONS**

- A. Maintain temperature of sheet flooring above 36 °C (65 °F), for 48 hours before installation.
- B. Maintain temperature of rooms where sheet flooring work occurs above 36 °C (65 °F), for 48 hours, before installation and during installation.
- C. After installation, maintain temperature at or above 36 °C (65 °F.)
- D. Building is permanently enclosed.
- E. Wet construction in or near areas to receive sheet flooring is complete, dry and cured.

**3.2 SUBFLOOR PREPARATION**

- A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710.
  - 1. Installer shall examine surfaces on which resilient sheet flooring is to be installed, and shall advise Contractor, in writing, of areas which are unacceptable for installation of flooring material. Installer shall advise Contractor which methods are to be used to correct conditions that will impair proper installation. Installation shall not proceed until unsatisfactory conditions have been corrected.
  - 2. Slab substrates shall be dry, free of curing compounds, sealers, hardeners, and other materials which would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by Flooring Manufacturer.

**SECTION 09 65 16**  
**RESILIENT SHEET FLOORING**

**3.2 SUBFLOOR PREPARATION (CONT)**

- B. Broom or vacuum clean substrates to be covered by sheet floor coverings immediately before installation. Following cleaning, examine substrates to determine if there is visually any evidence of moisture, alkaline salts, carbonation, or dust.
- C. Primer: If recommended by flooring manufacturer, prior to application of adhesive, apply concrete slab primer in accordance with manufacturer's directions.
- D. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- E. Fill cracks, joints, depressions, and other irregularities in concrete with leveling compound.
  - 1. Do not use adhesive for filling or leveling purposes.
  - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
  - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.
- F. Clean floor of oil, paint, dust and deleterious substances. Leave floor dry and cured free of residue from existing curing or cleaning agents.
- G. Moisture Testing: Perform moisture and pH test as recommended by the flooring and adhesive manufacturers. Proceed with installation only after concrete substrates meet or exceed the manufacturer's requirements.

**3.3 INSTALLATION OF FLOORING**

- A. Install work in strict compliance with manufacturer's instructions and approved layout drawings.
- B. Maintain uniformity of sheet vinyl floor covering direction and avoid cross seams.
- C. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 150 mm (6 inches) away from parallel joints in flooring substrates.
- D. Match edges of resilient floor coverings for color shading and pattern at seams.
- E. Where resilient sheet flooring abuts other flooring material floors shall finish level.
- F. Extend sheet vinyl floor coverings into toe spaces, door reveals, closets, and similar openings.
- G. Inform the Resident Engineer of conflicts between this section and the manufacturer's instructions or recommendations for auxiliary materials, or installation methods, before proceeding.
- H. Install sheet in full coverage adhesives.
  - 1. Air pockets or loose edges will not be accepted.
  - 2. Trim sheet materials to touch in the length of intersection at pipes and vertical projections; seal joints at pipe with waterproof cement or sealant.
- I. Keep joints to a minimum; avoid small filler pieces or strips.
- J. Follow manufacturer's recommendations for seams at butt joints. Do not leave any open joints that would be readily visible from a standing position.
- K. Follow manufacturer's recommendations regarding pattern match, if applicable.
- L. Installation of Edge Strips:
  - 1. Locate edge strips under center lines of doors unless otherwise indicated.
  - 2. Set aluminum strips in adhesive, anchor with lead anchors and stainless steel Phillips screws.
- M. Integral Cove Base Installation:
  - 1. Set preformed fillet strip to receive base.
  - 2. Install the base with adhesive, terminate expose edge with the cap strip.

**SECTION 09 65 16**  
**RESILIENT SHEET FLOORING**

**3.3 INSTALLATION OF FLOORING (CONT)**

3. Form internal and external corners to the geometric shape generated by the cove at either straight or radius corners.
4. Solvent weld joints as specified for the flooring. Seal cap strip to wall with an adhesive type sealant.
5. Unless otherwise specified or shown where sheet flooring is scheduled, provide integral base at intersection of floor and vertical surfaces. Provide sheet flooring and base scheduled for room on floors and walls under and behind areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.

**3.4 INSTALLATION OF INTEGRAL COVED BASE**

- A. Set preformed cove to receive base. Install base material with adhesive and terminate exposed edge with cap strip. Integral base shall be (4 inches) high.
- B. Internal and external corners shall be formed to geometric shape generated by cove at either square or radius corners.

**3.5 WELDING**

- A. Heat weld all joints of flooring and base using equipment and procedures recommended by flooring manufacturer.
- B. Welding shall consist of routing joint, inserting a welding rod into routed space, and terminally fusing into a homogeneous joint.
- C. Upon completion of welding, surface across joint shall finish flush, free from voids, and recessed or raised areas.
- D. Fusion of Material: Joint shall be fused a minimum of 65 percent through thickness of material, and after welding shall meet specified characteristics for flooring.

**3.6 CLEANING**

- A. Clean small adhesive marks during application of sheet flooring and base before adhesive sets, smearing will not be accepted.
- B. Remove visible adhesive and other surface blemishes using methods and cleaner recommended by floor covering manufacturers.
- C. Clean and polish materials per flooring manufacturer's written recommendations.
- E. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer's recommendations.
- F. Upon completion, Resident Engineer shall inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.
- G. Perform initial maintenance according to flooring manufacturer's written recommendations.

**3.7 PROTECTION:**

- A. Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades, or placement of fixtures and furnishings.
- B. Keep traffic off sheet flooring for 24 hours after installation.

**SECTION 09 65 16**  
**RESILIENT SHEET FLOORING**

**3.7 PROTECTION: (CONT)**

- C. Where construction traffic is anticipated, cover sheet flooring with reinforced kraft paper properly secured and maintained until removal is authorized by the Resident Engineer.
- D. Where protective materials are removed and immediately prior to acceptance, repair any damage, re-clean sheet flooring, lightly re-apply polish and buff floor if recommended by manufacturer.

- - - E N D - - -



**SECTION 09 65 19  
RESILIENT TILE FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the installation of solid vinyl tile flooring, vinyl composition tile flooring, rubber tile flooring, and accessories.

**1.2 RELATED WORK**

- A. Color and pattern and location in room finish schedule: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Description of each product.
  - 2. Resilient material manufacturers recommendations for adhesives, underlayment, primers and polish.
  - 3. Application and installation instructions.
- C. Samples:
  - 1. Tile: 300 mm by 300 mm (12 inches by 12 inches) for each type, pattern and color.
  - 2. Edge Strips: 150 mm (6 inches) long, each type.

**1.4 DELIVERY**

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

**1.5 STORAGE**

- A. Store materials in weathertight and dry storage facility.
- B. Protect from damage from handling, water, and temperature.

**1.6 EXTRA STOCK**

- A. Provide minimum 1 carton of each type and color of resilient tile flooring

**1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - E648-10.....Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source
  - E1155-96 (R2008) .....Determining Floor Flatness and Floor Levelness Numbers

**SECTION 09 65 19  
RESILIENT TILE FLOORING**

**1.7 APPLICABLE PUBLICATIONS (CONT)**

- F510-93 (R 2008) .....Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method
- F710-08 .....Preparing Concrete Floors to Receive Resilient Flooring
- C. Resilient Floor Covering Institute (RFCI):
  - IP #2 .....Installation Practice for Vinyl Composition Tile (VCT)
- D. Federal Specifications (Fed. Spec.):
  - SS-T-312 .....Tile Floor: Asphalt, Rubber, Vinyl and Vinyl Composition

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Furnish product type, materials of the same production run and meeting following criteria.
- B. Use adhesives, underlayment, primers and polish recommended by the floor resilient material manufacturer.
- C. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E 648.
- D. Smoke density: Less than 450 per ASTM E662.

**2.2 LINOLEUM TILE (LN-T1 & LN-T2)**

- A. ASTM F1303-90, Composition 1, Class I 50 cm (20 inches) square, thick. 2 mm (0.08 inch). Sheet flooring shall conform to ASTM F2034, homogeneous floor covering made of linseed oil, wood flour, limestone, dry pigments mixed and calendared onto a jute backing with a polyolefin comfort layer.
- B. Each color and pattern of sheet flooring shall be of same production run.
- C. Bacterial resistant.
- D. Impact Sound Reducer: 6db when test in accordance with ISO 20717-2 .
- E. Chemical Resistant: ASTM F 95
- F. Color and pattern uniformly distributed throughout thickness.
- G. Design Basis: Forbo Marmoleum Section 09 06 00, SCHEDULE FOR FINISHES.

**2.5 ADHESIVES**

- A. Comply with applicable regulations regarding toxic and hazardous materials Green Seal (GS-36) for commercial adhesive.
- B. Use low-VOC adhesive during installation. Water based is preferred over solvent based adhesives.

**2.6 PRIMER (FOR CONCRETE SUBFLOORS)**

As recommended by the adhesive and tile manufacturer.

**2.7 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.
- B. Determine the type of underlayment selected for use by the condition to be corrected.



**SECTION 09 65 19**  
**RESILIENT TILE FLOORING**

**2.8 CLEANERS**

- A. Cleaners per manufacturer's recommendation

**2.9 EDGE STRIPS**

- A. 28 mm (1-1/8 inch) wide unless shown otherwise.
- B. Bevel from maximum thickness to minimum thickness for flush joint unless shown otherwise.
- C. Resilient Edge Strip or Reducer Strip: Fed. Specs. SS-T-312, Solid vinyl.

**2.10 SCREWS**

- Stainless steel flat head screw.

**PART 3 - EXECUTION**

**3.1 PROJECT CONDITIONS**

- A. Maintain temperature of materials a minimum of 22 °C (70 °F,) for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs between 21 °C and 27 °C (70 °F and 80 °F), for at least 48 hours, before, during and after installation.
- C. Do not install flooring until building is permanently enclosed and wet construction in or near areas to receive tile materials is complete, dry and cured.

**3.2 SUBFLOOR PREPARATION**

- A. Verify that concrete slabs comply with ASTM F710. At existing slabs, determine levelness by F-number method in accordance with ASTM E1155. Overall value shall not exceed as follows:  
FF30/FL20
- B. Correct conditions which will impair proper installation.
- C. Fill cracks, joints and other irregularities in concrete with leveling compound:
  - 1. Do not use adhesive for filling or leveling purposes.
  - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
  - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joints.
- D. Clean floor of oil, paint, dust, and deleterious substances: Leave floor dry and cured free of residue from existing curing or cleaning agents.
- E. Concrete Subfloor Testing:  
Determine Adhesion and dryness of the floor by bond and moisture tests as recommended by RFCI manual MRP.
- F. Perform additional subfloor preparation to obtain satisfactory adherence of flooring if subfloor test patches allows easy removal of tile.
- G. Prime the concrete subfloor if the primer will seal slab conditions that would inhibit bonding, or if priming is recommended by the tile or adhesive manufacturers.

**3.3 INSTALLATION**

- A. Install in accordance with manufacturer's instructions for application and installation unless specified otherwise.

**SECTION 09 65 19  
RESILIENT TILE FLOORING**

**3.3 INSTALLATION (CONT)**

- B. Mix tile from at least two containers. An apparent line either of shades or pattern variance will not be accepted.
- C. Tile Layout:
  - 1. If layout is not shown on drawings, lay tile symmetrically about center of room or space with joints aligned.
  - 2. No tile shall be less than 150 mm (6 inches) and of equal width at walls.
  - 3. Place tile pattern in the same direction; do not alternate tiles.
- D. Trim tiles to touch for the length of intersections at pipes and vertical projections, seal joints at pipes with waterproof cement.
- E. Application:
  - 1. Apply adhesive uniformly with no bare spots.
    - a. Conform to RFC1-TM-6 for joint tightness and for corner intersection unless layout pattern shows random corner intersection.
    - b. More than 5 percent of the joints not touching will not be accepted.
  - 2. Roll tile floor with a minimum 45 kg (100 pound) roller. No exceptions.
  - 3. The Resident Engineer may have test tiles removed to check for non-uniform adhesion, spotty adhesive coverage, and ease of removal. Install new tile for broken or removed tile.
- F. Installation of Edge Strips:
  - 1. Locate edge strips under center line of doors unless otherwise shown.
  - 2. Set resilient edge strips in adhesive. Anchor metal edge strips with anchors and screws specified.
  - 3. Where tile edge is exposed, butt edge strip to touch along tile edge.

**3.4 CLEANING AND PROTECTION**

- A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.
- B. Keep traffic off resilient material for a minimum 72 hours after installation.
- C. Clean and polish materials in the following order:
  - 1. For the first two weeks sweep and damp mop only.
  - 2. After two weeks, scrub resilient materials with a minimum amount of water and a mild detergent. Leave surface clean and free of detergent residue.
  - 3. Apply polish to the floors in accordance with the polish manufacturer's instructions.
- D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by Resident Engineer. At entrances and where wheeled vehicles or carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by Resident Engineer.
- E. When protective materials are removed and immediately prior to acceptance, replace any damage tile, re-clean resilient materials.

**3.6 LOCATION**

- A. Unless otherwise specified or shown, install tile flooring, on floor under areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.
- B. Extend tile flooring for room into adjacent closets and alcoves.

- - - E N D - - -

**SECTION 09 67 23.50**  
**RESINOUS (EPOXY TERRAZZO) FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies epoxy terrazzo flooring systems with integral cove base.
- B. Resinous (Epoxy Terrazzo) Flooring Systems:
  - 1. Thinset Epoxy Matrix Terrazzo.

**1.2 RELATED WORK**

- A. Concrete and Moisture Vapor Barrier: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Sealants installed with Terrazzo: Section 07 92 00, JOINT SEALANTS.
- C. Color and location of each type of resinous (epoxy terrazzo) flooring: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Floor Drains: Division 22, PLUMBING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Description of each product to be provided.
  - 2. Application and installation instructions.
  - 3. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.
- C. Qualification Data: For Installer.
- E. Samples:
  - 1. Each color and texture specified in Section 09 06 00, SCHEDULE FOR FINISHES.
  - 2. Samples for verification: Provide 4 each (color and texture) resinous flooring system required, 6 inches (152 mm) square, applied to a rigid backing by installer for this project.
  - 4. Accessories: (6 inches) 152 mm long sample of exposed strip item.
- F. Shop Drawings: Include plans, sections, component details, and attachment to other trades. Indicate layout of the following:
  - 1. Patterns.
  - 2. Edge configurations.
  - 3. Divider strips.
  - 4. Control-joint strips.
  - 5. Accessory strips.
  - 6. Abrasive strips.
- G. Certifications and Approvals:
  - 2. Manufacturer's approval of installers.
- H. Warranty: As specified in this section.

**1.4 QUALITY ASSURANCE**

- A. Manufacture Certificate: Manufacture shall certify that a particular resinous flooring system has been in use for a minimum of ten years.

**SECTION 09 67 23.50**  
**RESINOUS (EPOXY TERRAZZO) FLOORING**

**1.4 QUALITY ASSURANCE (CONT)**

- B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this project for a minimum period of 5 years, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
  - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
  - 2. Contractor shall have completed at least 10 projects of similar size and complexity. Include list of at least 5 projects. List must include owner (purchaser); address of installation, contact information at installation project site; and date of installation.
  - 3. Installer's Personnel: Employ persons trained for application of specified product
- C. Source Limitations:
  - 1. Obtain primary resinous flooring materials including primers, resins, hardening agents, grouting coats and finish or sealing coats from a single manufacturer.
  - 2. Provide secondary materials, including marble chips strips, patching and fill material, joint sealant, and repair material of type and from source recommended by manufacturer of primary materials.
  - 3. Obtain marble chips color, grade, type, and variety of granular materials from one source with resources to provide materials of consistent quality in appearance and physical properties.
  - 4. Material furnished shall meet NTMA Specifications.
- D. NTMA Standards: Comply with NTMA's "Terrazzo Specification and Design Guide" and written recommendations for terrazzo type indicated unless more stringent requirements are specified.
- E. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and establish quality standards for materials and execution.
  - 1. Apply full-thickness mockups on 48 inch (1200 mm) square floor area selected by VA Resident Engineer.
    - a. Include 48 inch (1200 mm) length of integral cove base.
  - 2. Approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.
  - 3. Sign off from VA Resident Engineer on texture must be complete before installation of flooring system.
- F. Pre-Installation Conference:
  - 1. Convene a meeting not less than thirty days prior to starting work.
  - 2. Attendance:
    - a. Contractor
    - b. VA Resident Engineer
    - c. Manufacturer and Installer's Representative
    - d. Subcontractor/installer
  - 3. Review the following:
    - a. Environmental requirements
      - 1) Air and surface temperature

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**RESINOUS (EPOXY TERRAZZO) FLOORING**

2) Relative humidity

**1.4 QUALITY ASSURANCE (CONT)**

- 3) Ventilation
- 4) Dust and contaminants
- b. Protection of surfaces not scheduled to be coated
- c. Inspect and discuss condition of substrate and other preparatory work performed
- d. Review and verify availability of material; installer's personnel, equipment needed
- e. Design and pattern and edge conditions.
- f. Performance of the coating with chemicals anticipated in the area receiving the resinous (epoxy terrazzo) flooring system
- g. Application and repair
- h. Field quality control
- i. Cleaning
- j. Protection of coating systems
- k. One-year inspection and maintenance
- l. Coordination with other work
- G. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems throughout the contract until work is complete.
- H. Contractor Job Site Log: Contractor shall document daily; the work accomplished, environmental conditions and any other condition event significant to the long term performance of the terrazzo installation. The Contractor shall maintain these records for one year after Substantial Completion.

**1.5 MATERIAL PACKAGING DELIVERY AND STORAGE**

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Protect materials from damage and contamination in storage or delivery, including moisture, heat, cold, direct sunlight, etc.
- C. Maintain temperature of storage area between 60 and 80 degrees F (15 and 26 degrees C).
- D. Keep containers sealed until ready for use.
- E. Do not use materials beyond manufacturer's shelf life limits.

**1.6 PROJECT CONDITIONS**

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring applications.
  - 1. Maintain material and substrate temperature between 65 and 85 degrees F (18 and 30 degrees C) during resinous flooring application and for not less than 24 hours after application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

**SECTION 09 67 23.50  
RESINOUS (EPOXY TERRAZZO) FLOORING**

- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

**1.6 PROJECT CONDITIONS (CONT)**

- D. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

**1.7 WARRANTY**

- A. Work subject to the terms of the Article "Warranty of Construction" FAR clause 52.246-21.  
B. Warranty: Manufacture shall furnish a single, written warranty covering the full assembly (including substrata) for both material and workmanship for a extended period of (3) full years from date of installation, or provide a joint and several warranty signed on a single document by manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (3) full years from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

**1.8 APPLICABLE PUBLICATIONS**

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.  
B. ACI (American Concrete Institute):  
Comm. 503.1-92.....Four Epoxy Specifications (Reapproved 2003).  
C. American Society for Testing and Materials (ASTM):  
C109.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2" or 50 mm Cube Specimens)  
C131-06 .....Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine  
C150.....Standard Specification for Portland Cement  
C190-85 .....Method of Test for Tensile Strength of Hydraulic Cement Mortars (Withdrawn 1990)  
C219-07a .....Standard Terminology Relating to Hydraulic Cement  
C267-01(2006).....Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes  
C307-03 (2008).....Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing  
C580-02(2008).....Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes  
C881/C881M-02 .....Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete  
C882-05 .....Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear

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RESINOUS (EPOXY TERRAZZO) FLOORING**

D570-98(2005) .....Standard Test Method for Water Absorption of Plastics  
D638-08 .....Standard Test Method for Tensile Properties of Plastics

**1.8 APPLICABLE PUBLICATIONS (CONT)**

- D695-08 .....Standard Test Method for Compressive Properties of Rigid Plastics  
D696-08 .....Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer  
D1308-02(2007) .....Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes  
D1652-04 .....Standard Test Method for Epoxy Content of Epoxy Resins  
D4060-07 .....Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser  
E84-09c .....Standard Test Method for Surface Burning Characteristics of Building Materials  
F1869-09 .....Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride  
F2170-09 .....Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes  
G21-96(2002) .....Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi  
D. Army Corps of Engineers Guide Specs:  
245.05 .....Scratch Resistance  
E. National Terrazzo and Mosaic Association, Inc. (NTMA).  
"Terrazzo Specifications and Design Guide"  
"Terrazzo Color Palette"  
F. Terrazzo, Tile and Marble Association of Canada. (TTMAC).  
G. The Society For Protective Coatings (SSPC):  
SP6 .....Commercial Blast Cleaning  
H. Underwriters Laboratories (UL):  
UL410 .....Slip Resistance of Floor Surface Materials

**PART 2 - PRODUCTS**

**2.1 SYSTEM DESCRIPTION FOR RESINOUS (EPOXY TERRAZZO) FLOORING**

- A. System Descriptions:  
1. Monolithic, multi-layer, trowel applied multi-component epoxy urethane terrazzo and integral cove base. UV stable and breathable where required.  
B. Systems shall meet or exceed all applicable NTMA and TTMAC standards.  
C. System Components: Verify specific requirements as systems vary by manufacturer. Verify compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:  
1. Bond Coat (Primer): Verify inclusion of primer in manufacturer's system.  
a. Resin: Epoxy.  
b. Formulation Description: 100 percent solids.

**SECTION 09 67 23.50**  
**RESINOUS (EPOXY TERRAZZO) FLOORING**

- c. Binder: Formulated to meet physical properties of MIL-D-3134F.
- d. Application Method: Apply by spray, brush, or roller.

**2.1 SYSTEM DESCRIPTION FOR RESINOUS (EPOXY TERRAZZO) FLOORING (CONT)**

- 1) Thickness of coats: Verify thickness as systems vary by manufacturer; approximate range from 5 to 6 mils (0.13 to 0.15 mm) to 150 to 250 square feet per gallon (52.76 to 87.93 square meters per liter).
- 2. Body Coat:
  - a. Resin: Epoxy.
  - b. Formulation Description: 100 percent solids.
  - c. Binder: Formulated to meet physical properties of MIL-D-3134F.
  - d. Application Method: Varies by manufacturer; hand or power troweled.
    - 1) Trowel application:
      - a) Thickness of coat: Verify thickness as systems vary by manufacturer; approximate range from 3/16 inch or 1/4 inch or 3/8 inch (4.76 to either 6.35 mm or 9.5 mm).
      - b) Number of coats: One.
  - e. Aggregates: Verify amount per thickness as systems vary by manufacturer:
    - 1) Marble chips (#1 size maximum), glass, or granite chips or other approved materials. Colored rubberized aggregates
- 3. Grout Coat:
  - a. Resin: Epoxy.
  - b. Formulation Description: 100 percent solids.
  - c. Application Method: Varies by manufacturer. Apply by red rubber squeegee or spring-steel trowel.
    - 1) Apply to rough ground mortar coat to completely fill all voids.
    - 2) Thickness of coat: Verify thickness as systems vary by manufacturer; approximate range from a minimum of 8 to 10 mils (0.2 to 0.25 mm) to a maximum of 400 to 500 square feet per gallon (140.65 to 175.81 square meters per liter).
- 4. Seal Coat/Top Coat:
  - a. Resin: Single- or multi-component Urethane.
  - b. Formulation Description: 100% solids. It shall have a pH factor between 7 and 10 and shall be a penetrating type specially prepared for use on terrazzo. It shall not discolor or amber the terrazzo and shall produce a slip resistant surface. Flash point of sealer shall be a minimum of 80 degrees F (26 degrees C) when tested in accordance with [ASTM D 56](#).
  - c. Application Method: Varies by manufacturer.
    - 1) Apply to fine ground mortar coat to completely fill all voids.
    - 2) Thickness of coat: Verify thickness as systems vary by manufacturer; approximate range from a minimum of 4 to 5 mils (0.1 to 0.13 mm) to a maximum of 500 to 750 square feet per gallon (175.81 to 263.74 square meters per liter).
    - 3) Number of coats: One.
  - d. Aggregates: Verify inclusion of slip-retardant aggregates in seal coat/top coat.



**SECTION 09 67 23.50  
RESINOUS (EPOXY TERRAZZO) FLOORING**

- e. Textured Top Coat: Slip Resistant in accordance with UL 410.

**2.1 SYSTEM DESCRIPTION FOR RESINOUS (EPOXY TERRAZZO) FLOORING (CONT)**

**D. System Characteristics:**

1. Color and Pattern: As indicated in Section 09 06 00, SCHEDULE OF FINISHES.
2. Integral cove base: 1 inch (25.4 mm) radius epoxy mortar cove keyed into concrete substrate. Verify cove base installation with manufacturer's system.
3. Overall System Thickness: Verify thickness as systems vary by manufacturer; approximate range from a minimum of 3/16 inch (4.76 mm) to a maximum of either 1/4 inch or 3/8 inch (6.35 mm or 9.5 mm).
4. Finish: anti-slip resistant to meet or exceed 0.06 dry.

**E. Physical Properties:**

1. Conform to ASTM C722, Type A, Epoxy resin, quartz aggregate.
2. Other physical properties of seamless troweled (quartz epoxy) resinous flooring system in addition to C722 when tested to be as follows:

Test	Property	Value
ACI 503 R	Adhesion	350 psi /100% concrete failure
ASTM C-109	Compressive Strength	4000 PSI
ASTM C-190	Tensile Strength	800 PSI
ASTM C-307	Tensile Strength	800 PSI
ASTM C-413	Water Absorption	< 0.5%
ASTM C-531	Thermal Coefficient of Linear Expansion	$4.7 \times 10^{-8}$
ASTM C-579	Compressive Strength	6000 PSI
ASTM C-580	Flexural	2000 to 4500 psi
ASTM C-92	Flash Point	140 degrees F
ASTM D-635	Flame Spread	< 0.25 inches (6.35 mm)/self extinguishing
ASTM D-638	Tensile Strength	3000 psi
ASTM D-695	Compressive Strength	12,000 psi
ASTM D-696	Thermal Co-efficient of Linear Expansion	$14 \times 10^{-6}$ inch /inch /degrees F
ASTM D-790	Flexural Modulus	500000 psi
ASTM D-2240 Shore D	Surface Hardness	80-90
ASTM D-3960	Volatile Organic Compounds (VOC)	Primer Coat: 0 Base Coat: 0 Top Coat: 0
ASTM D-4060, CS-17	Abrasive Resistance	0<0.1 gm max weight loss
ASTM D-4541	Tensile Bond Strength	Cohesive Failure of Concrete
ASTM E-162	Flammability	<1
ASTM E-648	Critical Radiant Flux	<1

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<b>Test</b>	<b>Property</b>	<b>Value</b>
ASTM F-1679	Co-efficient of Friction	Dry - 0.81 Wet - 0.56
ASTM G-21	Microbial Resistant	Passes
Mil Std. 810E	Fungus Resistance	No Growth
Mil PFR-3134	Indentation Characteristics	<5% / no cracking and loosing
-	Skid Resistance	Must pass
-	Density	125 lb/cu. ft.

## **2.2 SUPPLEMENTAL MATERIALS**

- A. Waterproofing Membrane: Type recommended or produced by manufacturer of resinous (epoxy terrazzo) flooring for type of service and conditions as indicated in Drawings.
- B. Crack Isolation Membrane: Type recommended or produced by manufacturer of resinous floor coating.
- C. Anti-Microbial Additive: Incorporate anti-microbial chemical additive to prevent growth of most bacteria, algae, fungi, mold, mildew, yeast, etc.
- D. Strips:
  - 1. Dividing strips "L" shaped as manufactured for use with resinous (Epoxy Terrazzo) flooring system.
    - a. White alloy zinc, 18 (1.214mm) gauge.
    - b. Plastic dividing strips shall not be used.
  - 2. Control Joint double "L" shaped strips as manufactured for use with resinous (Epoxy Terrazzo) flooring system. Position strips back to back.
    - a. White alloy zinc, 16 gage.
    - b. Plastic strips shall not be used.
- E. Patching and Fill Material: Resinous product of or approved by resinous (Terrazzo) flooring manufacturer for application indicated.
- F. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service or joint conditioned indicated.

## **2.3 BASE CAP STRIP**

- A. Aluminum, Extruded: ASTM B221, Alloy 6063-T6.
- B. Shape for 3/16 inch (4.76 mm) depth of base material, "J" configuration.
- C. Finish:
  - 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
  - 2. Aluminum: NAAMM Amp 501:
    - a. Clear anodic coating, AA-C22A41 chemically etched medium matte, with Architectural Class 1, 0.018 mm (0.7 mils) or thicker.

**SECTION 09 67 23.50**  
**RESINOUS (EPOXY TERRAZZO) FLOORING**

**PART 3 - EXECUTION**

**3.1 INSPECTION**

- A. Examine the areas and conditions where resinous (epoxy terrazzo) flooring system with integral base is to be installed with the VA Resident Engineer.
- B. Moisture Vapor Emission Testing: Perform moisture vapor transmission testing in accordance with ASTM F1869 to determine the MVER of the substrate prior to commencement of the work.
  - 1. MVT threshold for resinous (terrazzo) flooring shall not exceed 3 lbs/1000 square feet in a 24 hour period.
  - 2. When MVT emission exceeds this limit, apply manufacturer's recommended vapor control primer or other corrective measures as recommended by manufacturer prior to application of flooring or membrane systems.
  - 3. Perform additional substrata preparation as recommended by resinous flooring manufacturer's technical representative to obtain satisfactory results of moisture vapor transmission testing prior to commencement of the work.
  - 4. Provide a written report showing test placement and results.

**3.2 PROJECT CONDITIONS**

- A. Maintain temperature of rooms (air and surface) where work occurs, between 70 and 90 degrees F (21 and 32 degrees C) for at least 48 hours, before, during, and 24 hours after installation. Maintain temperature at least 70 degrees F (21 degrees C) thereafter.
- B. Maintain relative humidity less than 75 percent.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.
- D. Maintain proper ventilation of the area during application and curing time period.
  - 1. Comply with infection control measures of the VA Medical Center.

**3.3 INSTALLATION REQUIREMENTS**

- A. The manufacturer's instructions for application and installation shall be reviewed with the VA Resident Engineer for the resinous (terrazzo) flooring system with integral cove base.
- B. Substrata shall be approved by manufacture technical representative.

**3.4 PREPARATION**

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
  - 1. Mechanically prepare substrates as follows:
    - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
    - b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.

**SECTION 09 67 23.50**  
**RESINOUS (EPOXY TERRAZZO) FLOORING**

**3.4 PREPARATION (CONT)**

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
3. Verify that concrete substrates are dry.
  - a. Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75 percent.
  - b. Perform maximum moisture-vapor-emission test, ASTM F 1869. Proceed with application only after substrates has obtained satisfactory results. If needed perform additional moisture tests until substrates pass testing.
4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for flooring manufacturer recommended joint fill material, and concrete crack treatment.
- F. Prepare wall to receive integral base:
  1. Verify wall material is acceptable for resinous flooring application, if not, install material (e.g. cement board) to receive base.
  2. Fill voids in wall surface to receive base, install undercoats (e.g. water proofing membrane, and/or crack isolation membrane) as recommended by resinous flooring manufacturer.
  3. Grind, cut or sand protrusions to receive base application.

**3.5 APPLICATION**

- A. General: Apply each component of resinous (epoxy terrazzo) flooring system with integral base according to manufacturer's directions to produce a uniform monolithic flooring surface of thickness indicated.
  1. Verify that the substrate (dryness, pH level, etc.) is acceptable by the manufacturer's technical representative.
  2. Use manufacturer recommended cleaning products.
- B. Prepare substrata for resinous (terrazzo) flooring system:
  1. Apply waterproof membrane as recommended by resinous flooring manufacturer at all vertical junctures and the entire flooring substrata. Embed fabric reinforcement into waterproof membrane liquid. Overlap all seams a minimum of 2 inches (51 mm).
  2. Apply crack isolation membrane as recommended by resinous flooring manufacturer.
  3. Apply substrata smoothing/patching underlayment as recommended by resinous flooring manufacturer.

**SECTION 09 67 23.50**  
**RESINOUS (EPOXY TERRAZZO) FLOORING**

**3.5 APPLICATION (CONT)**

- C. Resinous (epoxy terrazzo) flooring system: Per manufacturer's written instructions. Based on the porosity of the substrata additional coats may be required:
1. Primer (Bond) Coat.
  2. Strips: Set divider and control strips as indicated on plans. Strips shall be set in a full bed of epoxy adhesive and allowed to cure before proceeding with the work.
  3. Body Coat: Apply body coat (including aggregate) evenly over the primer (bond) coat to the desired thickness.
  4. Power grind to expose aggregate.
  5. Grout Coat.
  6. Progressively fine grind and polish floor. Cleanse terrazzo with potable water and rinse. Remove excess rinse water and apply grout using identical Portland cement, color pigments as used in topping, ensuring to fill all voids. Cure Grout as recommended by manufacturer.
    - a. Grout may be left on terrazzo until all heavy and messy work in project is completed.
    - b. Fine grind until all grout is removed from surface.
    - c. Upon completion, terrazzo flooring shall display a minimum of 70% of marble chips // aggregate//.
  7. Cleaning: Wash all surfaces with a neutral cleaner. Rinse with clean water and allow surface to dry
  8. Seal Coat (Top Coat). Apply sealing coats of type recommended by manufacturer to produce finish matching approved samples.
  9. Cove base: Apply cove base mix to wall surfaces at locations shown to form cove base to form //4-inch (101 mm)// //6-inch (152 mm)// cove base height //as shown in Drawings//. Follow manufacturer's instructions and details including taping, mixing, priming, troweling, grinding, polishing, and top-coating of cove base.
    - a. When wall surface is not concrete, concrete masonry unit, install cement board and/or exterior grade plywood at locations shown to form cove base.

**3.6 TOLERANCE**

- A. From line of plane: Maximum 1/8 inch (3.18 mm) in total distance of flooring and base.
- B. From radius of cove: Maximum of 1/8 inch (3.18 mm) plus or 1/16-inch (1.59 mm) minus.

**3.7 CURING, PROTECTION AND CLEANING**

- A. Cure resinous (epoxy terrazzo) flooring in compliance with manufacturer's directions (during the application process), taking care to prevent contamination during stages of application and prior to completion of curing process.
- B. Close area of application for a minimum of 24 hours.
- C. Protect resinous (epoxy terrazzo) flooring materials from damage and wear during construction operation.
  1. Cover flooring with wax paper or Kraft paper.

**SECTION 09 67 23.50**  
**RESINOUS (EPOXY TERRAZZO) FLOORING**

**3.7 CURING, PROTECTION AND CLEANING (CONT)**

2. Cover paper with 1/4 inch (6.35 mm) thick hardboard, plywood, or particle board where area is in foot or vehicle traffic pattern, rolling or fixed scaffolding and overhead work occurs.
- D. Remove temporary covering and clean resinous (Epoxy Terrazzo) flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous (Epoxy Terrazzo) flooring manufacturer.

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**SECTION 09 68 00  
CARPETING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Section specifies carpet, edge strips, adhesives, and other items required for complete installation.

**1.2 RELATED WORK**

- A. Color and texture of carpet and edge strip: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Resilient wall base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

**1.3 QUALITY ASSURANCE**

- A. Carpet installed by mechanics certified by the Floor Covering Installation Board.
- B. Certify and label the carpet that it has been tested and meets criteria of CRI IAQ Carpet Testing Program for indoor air quality.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
  - 1. Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame resistance characteristics for each type of carpet material and installation accessory.
  - 2. Manufacturer's printed installation instructions for the carpet, including preparation of installation substrate, seaming techniques and recommended adhesives and tapes.
  - 3. Manufacturer's certificate verifying carpet containing recycled materials include percentage of recycled materials as specified.
- C. Samples:
  - 1. Carpet: "Production Quality" samples 300 x 300 mm (12 x 12 inches) of carpets, showing quality, pattern and color specified in Section 09 06 00, SCHEDULE FOR FINISHES.
  - 2. Floor Edge Strip (Molding): 150 mm (6 inches) long of each color and type specified.
  - 3. Base Edge Strip (Molding): 150 mm (6 inches) long of each color specified.
- D. Shop Drawings: Installers layout plan showing seams and cuts for sheet carpet and carpet module.
- E. Maintenance Data: Carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

**1.5 DELIVERY AND STORAGE**

- A. Deliver carpet in manufacturer's original wrappings and packages clearly labeled with manufacturer's name, brand, name, size, dye lot number and related information.
- B. Deliver adhesives in containers clearly labeled with manufacturer's name, brand name, number, installation instructions, safety instructions and flash points.
- C. Store in a clean, dry, well ventilated area, protected from damage and soiling. Maintain storage space at a temperature above 16 degrees C (60 degrees F) for 2 days prior to installation.

**SECTION 09 68 00**  
**CARPETING**

**1.6 ENVIRONMENTAL REQUIREMENTS**

Areas in which carpeting is to be installed shall be maintained at a temperature above 16 degrees C (60 degrees F) for 2 days before installation, during installation and for 2 days after installation. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

**1.7 WARRANTY**

Carpet and installation subject to terms of "Warranty of Construction" FAR clause 52.246-21, except that warranty period is extended to two years.

**1.8 EXTRA STOCK**

- A. Provide minimum of 100 sf of additional carpet tile for each style and color for Owner use.

**1.9 APPLICABLE PUBLICATIONS**

- A. Publication listed below form a part of this specification to extent referenced.  
Publications are referenced in text by basic designation only.
- C. American Association of Textile Chemists and Colorists (AATCC):  
AATCC 16-04.....Colorfastness to Light  
AATCC 134-11.....Electric Static Propensity of Carpets
- D. American Society for Testing and Materials (ASTM):  
ASTM D5116-10.....Determinations of Organic Emissions from Indoor Materials/Products  
ASTM E648-10 .....Critical Radiant Flux of Floor-Covering Systems Using a  
Radiant Heat Energy Source
- E. The Carpet and Rug Institute (CRI):  
CRI 104-11 .....Installation of Commercial Carpet

**PART 2 - PRODUCTS**

**2.1 CARPET (CPT-1)**

- A. Physical Characteristics:
1. Carpet free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains and other physical and manufacturing defects.
  2. Manufacturers standard construction commercial carpet:
    - a. Modular Tile: 50cm x 50cm (19.69x19.69 inches) square tile.
  3. Provide static control to permanently control static build up to less than 3.0 kV when tested at 20 percent relative humidity and 21 degrees C (70 degrees F) in accordance with AATCC 134.
  4. Pile Height: Maximum 4.1 mm (0.16 inch).
  5. Pile Fiber: Post -consumer Content Type 6, 6 Nylon
  6. Pile Type: Tufted Cut & Loop.
  7. Backing materials: GlacBac® RE Tile
  8. Flammability and Critical Radiant Flux Requirements:



**SECTION 09 68 00  
CARPETING**

- a. Test Carpet in accordance with ASTM E 648.
- b. Class I: Not less than 0.45 watts per square centimeter.
- d. Carpet in corridors, exits and Medical Facilities: Class I.
- 9. Density: Average Pile Yarn Density (APYD): 7266
- 10. Tufted Yarn Weight: 746.0g/m<sup>2</sup> (22oz/yd<sup>2</sup>)
- 11. Machine Gauge: 50.4 ends/10cm (5/64 inch)
- 12. Pile Thickness: 2.8mm (0.109 inches)
- 13. Stitches: 39.37 ends/ 10 cm (10.0/inch)
- 14. Total Thickness: 7.52mm (0.30 inch)
- C. Color, Texture, and Pattern: As specified in Section 09 06 00, SCHEDULE FOR FINISHES.

**2.2 CARPET (CPT-2)**

- A. Physical Characteristics:
  - 1. Carpet free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains and other physical and manufacturing defects.
  - 2. Manufacturers standard construction commercial carpet:
    - a. Modular Tile: 50cm x 50cm (19.69x19.69 inches) square tile.
  - 3. Provide static control to permanently control static build up to less than 3.0 kV when tested at 20 percent relative humidity and 21 degrees C (70 degrees F) in accordance with AATCC 134.
  - 4. Pile Height: Maximum 5.1 mm (0.2 inch).
  - 5. Pile Fiber: Post -consumer Content Type 6, 6 Nylon
  - 6. Pile Type: Tufted Cut & Loop.
  - 7. Backing materials: GlacBac® RE Tile
  - 8. Flammability and Critical Radiant Flux Requirements:
    - a. Test Carpet in accordance with ASTM E 648.
    - b. Class I: Not less than 0.45 watts per square centimeter.
    - d. Carpet in corridors, exits and Medical Facilities: Class I.
  - 9. Density: Average Pile Yarn Density (APYD): 5178
  - 10. Tufted Yarn Weight: 712.0g/m<sup>2</sup> (21oz/yd<sup>2</sup>)
  - 11. Machine Gauge: 50.4 ends/10cm (5/64 inch)
  - 12. Pile Thickness: 3.7mm (0.146 inches)
  - 13. Stitches: 39.37 ends/ 10 cm (10.0/inch)
  - 14. Total Thickness: 7.42mm (0.29 inch)
- C. Color, Texture, and Pattern: As specified in Section 09 06 00, SCHEDULE FOR FINISHES

**2.3 ADHESIVE AND CONCRETE PRIMER**

- A. Waterproof, resistant to cleaning solutions, steam and water, nonflammable, complies with air-quality standards as specified. Adhesives flashpoint minimum 60 degrees C (140 degrees F), complies with ASTM D 3278.
- B. Seam Adhesives: Waterproof, non-flammable and non-staining.

**SECTION 09 68 00  
CARPETING**

**2.4 EDGE STRIPS (MOLDING)**

- B. Vinyl Edge Strip:
  - 1. Beveled floor flange minimum 50 mm (2 inches) wide.
  - 2. Beveled surface to finish flush with carpet for tight joint and other side to floor finish.
  - 3. Color as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

**2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

- A. Provide Portland cement bases polymer modifier with latex or polyvinyl acetate resin manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Determine the type of underlayment selected for use by condition to be corrected and manufacturers compatibility.

**PART 3 - EXECUTION**

**3.1 SURFACE PREPARATION**

- A. Examine surfaces on which carpeting is to be installed.
- B. Clean floor of oil, waxy films, paint, dust and deleterious substances that prevent adhesion, leave floor dry and cured, free of residue from curing or cleaning agents
- C. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- D. Fill cracks, joints depressions, and other irregularities in concrete with leveling compound.
  - 1. Do not use adhesive for filling or leveling purposes.
  - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
  - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.
- E. Test new concrete subfloor prior to adhesive application for moisture and surface alkalinity per CRI 104 Section 6.3.1 or per ASTM E1907.

**3.2 CARPET INSTALLTION**

- A. Do not install carpet until work of other trades including painting is complete and dry.
- B. Install in accordance with CRI 104 installation.
  - 1. Relax carpet in accordance with Section 6.4.
  - 2. Comply with indoor air quality recommendations noted in Section 6.5.
  - 3. Maintain temperature in accordance with Section 15.3.
- C. Secure carpet to subfloor with adhesive applied as recommended by carpet manufacturer.
- D. Follow carpet manufacturer's recommendations for matching pattern and texture directions.
- E. Cut openings in carpet where required for installing equipment, pipes, outlets, and penetrations.
  - 1. Bind or seal cut edge of sheet carpet and replace flanges or plates.
  - 2. Use additional adhesive to secure carpets around pipes and other vertical projections.
- F. Carpet Modules:
  - 1. Install per CRI 104, Section 13, Adhesive Application.
  - 2. Lay carpet modules with pile in same direction unless specified other wise in Section 09 06 00, SCHEDULE FOR FINISHES.

**SECTION 09 68 00  
CARPETING**

**3.2 CARPET INSTALLTION (CONT)**

3. Install carpet modules so that cleaning methods and solutions do not cause dislocation of modules.
4. Lay carpet modules uniformly to provide tight flush joints free from movement when subject to traffic.

**3.3 EDGE STRIPS INSTALLATION**

- A. Install edge strips over exposed carpet edges adjacent to uncarpeted finish flooring.
- B. Anchor metal strips to floor with suitable fasteners. Apply adhesive to edge strips, insert carpet into lip and press it down over carpet.
- C. Anchor vinyl edge strip to floor with adhesive apply adhesive to edge strip and insert carpet into lip and press lip down over carpet.

**3.4 PROTECTION AND CLEANING**

- A. Remove waste, fasteners and other cuttings from carpet floors.
- B. Vacuum carpet and provide suitable protection. Do not use polyethylene film.
- C. Do not permit traffic on carpeted surfaces for at least 48 hours after installation. Protect the carpet in accordance with CRI 104.
- D. Do not move furniture or equipment on unprotected carpeted surfaces.
- E. Just before final acceptance of work, remove protection and vacuum carpet clean.

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**SECTION 09 72 16**  
**VINYL-COATED FABRIC WALL COVERINGS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Section specifies vinyl coated fabric wallcovering and installation.

**1.2 RELATED WORK**

- A. Color, pattern, type, direction of hanging and areas to receive wallcovering: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
1. Each type and pattern as specified in Section 09 06 00, SCHEDULE FOR FINISHES.
  2. Size: Full width of mill run.
- C. Manufacturer's Certificates:
1. Compliance with CFFA W-101D.
  2. Wallcovering manufacturer's approval of adhesive.
- D. Manufacturer's Literature and Data:
1. Primer and adhesive.
  2. Installation instructions.
  3. Maintenance instructions, including recommended materials and methods for maintaining wallcovering with precautions in use of cleaning material.

**1.4 QUALITY ASSURANCE**

- A. Finish one complete space with each type (color and pattern) of wallcovering showing specified colors and patterns.
- B. Use approved sample spaces as a standard for work throughout the project.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. Deliver in original unopened containers bearing the manufacturer's name, brand name, and product designation.
- B. Store in accordance with manufacturer's instructions.
- C. Handle to prevent damage to material.

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Chemical Fabrics and Film Association, Inc., (CFFA):  
2575-96(R2011)..... Vinyl Coated Fabric Wallcovering
- C. American Society for Testing and Materials (ASTM)  
G21-09 .....Determining Resistance of Synthetic Polymeric Materials  
to Fungi

**SECTION 09 72 16**  
**VINYL-COATED FABRIC WALL COVERINGS**

**PART 2 - PRODUCTS**

**2.1 VINYL COATED FABRIC WALLCOVERING**

- A. Comply with CFFA-2575.
- B. Fungi Resistance: ASTM G21, rating of 0.
- C. Factory-applied clear delustered polyvinyl-fluoride (PVF) coating:
  - 1. Minimum 0.0125 mm (1/2 mil) thickness.
  - 2. Fire hazard classification with PVF coating: Class A unless specified otherwise.
- D. Type II (Medium Duty).
- E. Width: 54 inches.
- F. Vinyl Weight: 12.2 oz. per sq. Yd
- G. Tear Strength: 35x30.
- H. Permeability Rating:1

**2.2 ADHESIVE**

- A. Use only water-based adhesive having volatile organic compounds not more than 50 g/l, compliant with manufacturers recommendation.
- B. Vermin and mildew resistant.

**PART 3 - EXECUTION**

**3.1 JOB CONDITIONS**

- A. Temperatures:
  - 1. Do not perform work until surfaces and materials have been maintained at minimum of 60 °F. for three days before work begins.
  - 2. Maintain minimum temperatures of 60 °F. until adhesives are dried or cured.
- B. Lighting:
  - 1. Do not proceed unless a minimum lighting level of 15 candlepower per square foot occurs.
  - 2. Measure light level at mid-height of wall.
- C. Ventilation:
  - 1. Provide uniform continuous ventilation in space.
  - 2. Ventilate for a time for not less than complete drying or curing of adhesive.
- D. Protect other surfaces from damage which may be caused by this work.
- E. Remove waste from building daily.

**3.2 SURFACE CONDITION**

- A. Inspect surfaces to receive wallcoverings to assure that:
  - 1. Patches and repairs are completed.
  - 2. Surface are clean, smooth and prime painted.
- B. Do not proceed until discovered defects have been corrected by other trades and surfaces are ready to receive wallcovering.
- C. Carefully remove electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings and fastenings, prior to starting work.
- D. Carefully store items for reinstallation.

**SECTION 09 72 16**  
**VINYL-COATED FABRIC WALL COVERINGS**

**3.3 APPLICATION OF ADHESIVE**

- A. Mix and apply adhesives in accordance with manufacturer's directions.
- B. Prevent adhesive from getting on face of wallcovering.
- C. Apply adhesive to wallcovering back.

**3.4 WALLCOVERING INSTALLATION**

- A. Use wallcovering of same batch or run in an area. Use fabric rolls in consecutive numerical sequence of manufacture.
- B. Install material completely adhered, smooth, clean, without wrinkles, air pockets, gaps or overlaps.
- C. Extend wallcovering continuous behind non-built-in casework and other items which are close to but not bolted to or touching the walls.
- D. Install wallcovering before installation of resilient base. Extend wallcovering not more than 6 mm (1/4 inch) below top of resilient base.
- E. Install panels consecutively in order in which they are cut from the roll including filling spaces above or below windows, doors, or similar penetrations.
- F. Do not install horizontal seams.
- G. Except on match patterns, hang fabric by reversing alternate strips, except as recommended by the manufacturer.
- H. Cutting:
  - 1. Cut on a work table with a straight edge.
  - 2. Joints or seams that are not cut clean are unacceptable.
  - 3. Trim additional selvage to achieve a color and pattern match at seams. Overlapped seams are not allowed.
  - 4. Do not double cut seams on wall unless specified.
  - 5. If double cutting on the wall is necessary, place a three inch strip of Type I wallcovering under pasted edge.
    - a. Do not cut into wall surface.
    - b. After cutting, remove strip and excess adhesive from seam before proceeding to next seam.
    - c. Smooth down seam in adhesive for tight bond and joint.
- I. Trim strip-matched patterns, which are not factory pre-trimmed.
- J. Inside Corners:
  - 1. Wrap wallcovering around corner.
  - 2. Do not seam within 50 mm (2 inches) of inside corners.
  - 3. Double cut seam.
- K. Outside Corners:
  - 1. Wrap wallcovering around corner.
  - 2. Do not seam within 150 mm (6 inches) of outside corners.
  - 3. Double cut seam.

**SECTION 09 72 16**  
**VINYL-COATED FABRIC WALL COVERINGS**

**3.5 PATCHING**

- A. Replace surface damaged wallcovering in a space as specified for new work:
  - 1. Replace full height of surface.
  - 2. Replace from break in plane to break in plane when same batch or run is not used.  
Double cut seams.
  - 3. Adjoining differential colors from separate batches or runs are not acceptable.
- B. Correct loose or raised seams with adhesives to lay flat with tight bonded joint as specified for new work.

**3.6 CLEANING AND INSTALLING TEMPORARY REMOVED ITEMS**

- A. Remove adhesive from wallcovering as work proceeds.
- B. Remove adhesives where spilled, splashed or splattered on wallcoverings or adjacent surfaces in a manner not to damage surface from which it is removed.
- C. Reinstall previously removed electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings and fastenings.

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**SECTION 09 84 33**  
**SOUND-ABSORBING WALL UNITS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the requirements for fabric covered acoustical wall panels.

**1.2 RELATED WORK**

Color and location for hanging: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced.  
The publications are referenced in text by basic designation only.
- B. American Association of Textile Chemists and Colorists (AATCC):  
TM 16-04.....Test Method: Colorfastness to Light
- C. American Society for Testing and Materials (ASTM):  
C 423-08 .....Sound Absorption and Sound Absorption Coefficients by  
the Reverberation Room Method  
D 1117-01 .....Nonwoven Fabrics  
E 84-10.....Surface Burning Characteristics of Building Materials

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Fabric Covering in quadruplicate, as specified in Section 09 06 00, SCHEDULE FOR FINISHES, size 200 mm (1/4 yard), full width of mill run for each color specified.
- C. Manufacturer's Literature and Data: Complete instructions for installation of wall panels.
- D. Certificate: Flame spread smoke density factors.

**PART 2 - PRODUCTS**

**2.1 WALL COVERING PANELS**

- A. Width: 600 mm (24-inches) unless shown otherwise. End filler panels may vary in width as necessary to cover wall to wall installation.
- B. Height:
  - 1. For full height panels field measure panels for custom fit flush to ceiling and tolerance at floor to within 3 mm (1/8-inch) at top of base.
  - 2. Height for other panels as shown.

**SECTION 09 84 33**  
**SOUND-ABSORBING WALL UNITS**

- C. Thickness: 25 mm (1 inch) nominal.
- D. Fabric Covering: Seamless // non-woven, embossed texture, needle punched 100 percent polyester, minimum 0.034 kg per linear meter (11 ounces per linear yard). Tear strength shall be minimum 110 N (25 pounds) machine direction and minimum 178 N (40 pounds) cross-machine direction in accordance with ASTM D 1117. Tensile strength shall be minimum 220 N (50 pounds) machine direction and minimum 330 N (75 pounds) cross-machine direction in accordance with ASTM D 5034// // plain woven 2-ply 100 percent polyester, minimum 0.47 kg per linear meter (15 ounces per linear yard). Tear strength shall be minimum 129 N (29 pounds). Tensile strength shall be 667 N (150 pounds) minimum in accordance with ASTM D 5034 // // perforated vinyl covering with fabric backing, minimum 0.62 kg per linear meter (20 ounces per linear yard) total weight. // Fabric covering shall be stretched free of wrinkles and then bonded to the edges and back or bonded directly to the panel face, edges, and back of panel a minimum distance standard with the manufacturer. Light fastness (fadeometer) shall be approximately 40 hours in accordance with AATCC TM 16.
- E. Fire rating for the complete composite system: Class A, 200 or less smoke density and flame spread less than 25, when tested in accordance with ASTM E 84.
- F. Substrate: Fiber glass or mineral fiber.
- G. Noise Reduction Coefficient (NRC) Range: (0.50-0.60) (0.80-0.90) ASTM C 423.

**2.2 ALUMINUM**

- A. Manufacturers standard concealed aluminum mounting system.
- B. Mounting system shall be capable of supporting twice the weight of the panel.

**2.3 FASTENERS**

Use toggle bolts: Wire wings are not acceptable.

**PART 3 - EXECUTION**

**3.1 WALL PREPARATION**

Walls shall be clean, smooth, oil free, contain no protrusions, and prepared in accordance with manufacturers printed instructions.

**3.2 INSTALLATION**

- A. Apply panels using concealed aluminum splines, bolted to wall surfaces in accordance with the manufacturer's installation instructions.
- B. Locate panels as shown.

**SECTION 09 84 33**  
**SOUND-ABSORBING WALL UNITS**

**--- E N D ---**



**SECTION 09 91 00  
PAINTING**

**PART 1-GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies field painting.
- B. Section specifies prime coats which may be applied in shop under other sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

**1.2 RELATED WORK**

- A. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS, Division 10 - SPECIALTIES, Division 11 - EQUIPMENT, Division 12 - FURNISHINGS, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY sections.
- B. Contractor option: Prefinished flush doors with transparent finishes: Section 08 14 00, WOOD DOORS.
- C. Type of Finish, Color, and Gloss Level of Finish Coat: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Asphalt and concrete pavement marking: Section 32 17 23, PAVEMENT MARKINGS.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:  
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- C. Sample Panels:
  - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
  - 2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
  - 3. Panel to show transparent finishes: Wood of same species and grain pattern as wood approved for use, 100 by 250 by 3 mm (4 inch by 10 inch face by 1/4 inch) thick minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 by 50 mm (2 by 2 inch) minimum or actual wood member to show complete finish.
  - 4. Attach labels to panel stating the following:
    - a. Federal Specification Number or manufacturers name and product number of paints used.
    - b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.

**SECTION 09 91 00  
PAINTING**

**1.3 SUBMITTALS (CONT)**

- c. Product type and color.
- d. Name of project.
- 5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

**1.4 DELIVERY AND STORAGE**

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
  - 1. Name of manufacturer.
  - 2. Product type.
  - 3. Batch number.
  - 4. Instructions for use.
  - 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
  - 1. Federal Specification Number, where applicable, and name of material.
  - 2. Surface upon which material is to be applied.
  - 3. If paint or other coating, state coat types; prime, body or finish.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
- C. American National Standards Institute (ANSI):
  - A13.1-07 .....Scheme for the Identification of Piping Systems
- D. Federal Specifications (Fed Spec):
  - TT-P-1411A .....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)
- E. Master Painters Institute (MPI):
  - No. 11-07.....Exterior Latex, Semi-Gloss (AE)
  - No. 18-07.....Organic Zinc Rich Primer
  - No. 22-07.....Aluminum Paint, High Heat (up to 590° - 1100F) (HR)
  - No. 43-07.....Interior Satin Latex, MPI Gloss Level 4
  - No. 45-07.....Interior Primer Sealer
  - No. 46-07.....Interior Enamel Undercoat
  - No. 47-07.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)
  - No. 50-07.....Interior Latex Primer Sealer

**SECTION 09 91 00  
PAINTING**

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Wood Sealer: MPI 31 (gloss) or MPI 71 (flat) thinned with thinner recommended by manufacturer at rate of about one part of thinner to four parts of varnish.
- B. Exterior/ interior Alkyd Floor Enamel, Gloss (FE): MPI 27.
- C. Interior Satin Latex: MPI 43.
- D. Interior Enamel Undercoat: MPI 47.
- E. Interior Alkyd, Semi-Gloss (AK): MPI 47.
- F. Interior Latex Primer Sealer: MPI 50.
- G. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.
- H. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.
- I. Epoxy Cold Cured, Gloss (EC): MPI 77.
- J. Interior Wood Stain, Semi-Transparent (WS): MPI 90.
- K. Wood Filler Paste: MPI 91.

**2.2 PAINT PROPERTIES**

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

**2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE**

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
  - 1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
  - 2. Use high performance acrylic paints in place of alkyd paints, where possible.
  - 3. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons by weight.

**PART 3 - EXECUTION**

**3.1 JOB CONDITIONS**

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
  - 1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
  - 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.
- B. Atmospheric and Surface Conditions:
  - 1. Do not apply coating when air or substrate conditions are:
    - a. Less than 3 degrees C (5 degrees F) above dew point.
    - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer.

**SECTION 09 91 00**  
**PAINTING**

**3.1 JOB CONDITIONS (CONT)**

Under no circumstances shall application conditions exceed manufacturer recommendations.

2. Maintain interior temperatures until paint dries hard.
3. Do no exterior painting when it is windy and dusty.
4. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
5. Apply only on clean, dry and frost free surfaces except as follows:
  - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
  - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.
6. Varnishing:
  - a. Apply in clean areas and in still air.
  - b. Before varnishing vacuum and dust area.
  - c. Immediately before varnishing wipe down surfaces with a tack rag.

**3.2 SURFACE PREPARATION**

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
  1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
  2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
  3. See other sections of specifications for specified surface conditions and prime coat.
  4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.
- C. Wood:
  1. Sand to a smooth even surface and then dust off.
  2. Sand surfaces showing raised grain smooth between each coat.
  3. Wipe surface with a tack rag prior to applying finish.
  5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
  6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
  7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
    - a. Thin filler in accordance with manufacturer's instructions for application.
    - b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.
- D. Ferrous Metals:
  1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).



**SECTION 09 91 00  
PAINTING**

**3.2 SURFACE PREPARATION (CONT)**

2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
  3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
    - a. This includes flat head countersunk screws used for permanent anchors.
    - b. Do not fill screws of item intended for removal such as glazing beads.
  4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
  5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.
- E. Gypsum Board:
1. Remove efflorescence, loose and chalking plaster or finishing materials.
  2. Remove dust, dirt, and other deterrents to paint adhesion.
  3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound)] finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

**3.3 PAINT PREPARATION**

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

**3.4 APPLICATION**

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.

**SECTION 09 91 00**  
**PAINTING**

**3.4 APPLICATION (CONT)**

- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Resident Engineer.
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.
  - 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
  - 2. In areas, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.
- G. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

**3.5 PRIME PAINTING**

- A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.
- E. Wood and Wood Particleboard:
  - 1. Use same kind of primer specified for exposed face surface.
    - a. Exterior wood: MPI 7 (Exterior Oil Wood Primer) for new construction and MPI 5 (Exterior Alkyd Wood Primer) for repainting bare wood primer except where MPI 90 (Interior Wood Stain, Semi-Transparent (WS)) is scheduled.
    - b. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
  - 2. Apply one coat of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.
  - 3. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.
- F. Metals except boilers, incinerator stacks, and engine exhaust pipes:
  - 1. Steel and iron: MPI 95 (Fast Drying Metal Primer) MPI 77 (Epoxy Cold Cured, Gloss (EC)) finish is specified.
  - 2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer)
  - 3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
  - 4. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel (EO)).
  - 5. Asphalt coated metal: MPI 1 (Aluminum Paint (AP)).

**SECTION 09 91 00  
PAINTING**

**3.5 PRIME PAINTING (CONT)**

**G. Gypsum Board:**

1. Surfaces scheduled to have MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) MPI 114 (Interior Latex, Gloss (LE) and (LG)) finish: Use MPI 53 (Interior Latex, MPI Gloss Level 3 (LE)) MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)) MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE))
2. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) MPI 46 (Interior Enamel Undercoat) in shower and bathrooms.
3. Surfaces scheduled to receive vinyl coated fabric wallcovering:  
Use MPI 45 (Interior Primer Sealer)
4. Use MPI 101 (Cold Curing Epoxy Primer) for surfaces scheduled to receive MPI 77 (Epoxy Cold Cured, Gloss (EC))

**H. Concrete Masonry Units except glazed or integrally colored and decorative units:**

1. MPI 4 (Block Filler) on interior surfaces.
2. Prime exterior surface as specified for exterior finishes.

**3.6 EXTERIOR FINISHES**

**A. Apply following finish coats where specified in Section 09 06 00, SCHEDULE FOR FINISHES.**

**B. Steel and Ferrous Metal,:**

1. Two coats of MPI 8 (Exterior Alkyd, Flat (EO)) MPI 94 (Exterior Alkyd, Semi-Gloss (EO)) on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).

**C. Machinery without factory finish except for primer: One coat MPI 8 (Exterior Alkyd, Flat (EO)) MPI 94 (Exterior Alkyd, Semi-Gloss (EO)).**

**D. Concrete Masonry Units:**

1. General:
  - a. Where specified in Section 09 06 00, SCHEDULE FOR FINISHES or shown.
  - b. Mix as specified in manufacturer's printed directions.
  - c. Do not mix more paint at one time than can be used within four hours after mixing. Discard paint that has started to set.
  - d. Dampen warm surfaces above 24 degrees C (75 degrees F) with fine mist of water before application of paint. Do not leave free water on surface.
  - e. Cure paint with a fine mist of water as specified in manufacturer's printed instructions.
2. Use two coats of TT-P-1411 (Paint, Co-polymer-Resin, Cementitious (CEP)), unless specified otherwise.

**3.7 INTERIOR FINISHES**

**A. Apply following finish coats over prime coats in spaces or on surfaces specified in Section 09 06 00, SCHEDULE FOR FINISHES.**

**B. Metal Work:**

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.

**SECTION 09 91 00  
PAINTING**

**3.7 INTERIOR FINISHES (CONT)**

3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
  - a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) unless specified otherwise.
  - b. Two coats of MPI 48 (Interior Alkyd Gloss (AK))
  - c. One coat of MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) on exposed interior surfaces of alkyd-amine enamel prime finished windows.
  - e. Machinery: One coat MPI 9 (Exterior Alkyd Enamel (EO)).
  - f. Asphalt Coated Metal: One coat MPI 1 (Aluminum Paint (AP)).
- C. Gypsum Board:
  1. One coat of MPI 45 (Interior Primer Sealer) plus one coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE))
- D. Masonry and Concrete Walls:
  1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.
  2. Two coats of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE))
- E. Wood:
  1. Paint Finish:
    - a. One coat of MPI 45 (Interior Primer Sealer) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) (SG).
  2. Transparent Finishes on Wood Except Floors.
    - a. Natural Finish:
      - 1) One coat of sealer as written in 2.1 E.
      - 2) Two coats of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss (PV)).
    - b. Stain Finish:
      - 1) One coat of MPI 90 (Interior Wood Stain, Semi-Transparent (WS)).
      - 2) Use wood stain of type and color required to achieve finish specified. Do not use varnish type stains.
      - 3) Two coats of MPI 31 (Polyurethane Moisture Cured, Clear Gloss (PV))
    - c. Varnish Finish:
      - 1) One coat of sealer as written in 2.1 E.
      - 2) Two coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat (PV)) // MPI 31 (Polyurethane Moisture Cured, Clear Gloss (PV)).

**3.9 PAINT COLOR**

- A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.
- C. Coat Colors:
  1. Color of priming coat: Lighter than body coat.
  2. Color of body coat: Lighter than finish coat.
  3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
  1. Paint to match color of casework where casework has a paint finish.

**SECTION 09 91 00  
PAINTING**

**3.9 PAINT COLOR (CONT)**

2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

**3.10 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE**

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified under paragraph H, colors.
- C. Paint various systems specified in Division 02 - EXISTING CONDITIONS, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY.
- D. Paint after tests have been completed.
- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.
- G. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.
- H. Color:
  1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
  2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:
    - a. White .....Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
    - b. Gray: .....Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
    - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
    - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
    - e. Federal Safety Orange: .Entire lengths of electrical conduits containing feeders 600 volts or more.
    - f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.

**SECTION 09 91 00  
PAINTING**

**3.10 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE (CONT)**

- I. Apply paint systems on properly prepared and primed surface as follows:
  - 1. Exterior Locations:
    - a. Apply two coats of MPI 94 (Exterior Alkyd, Semi-gloss (EO)) to the following ferrous metal items:  
Vent and exhaust pipes with temperatures under 94 degrees C (200 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
    - b. Apply two coats of MPI 11 (Exterior Latex, Semi Gloss (AE)) to the following metal items:  
Galvanized and zinc-copper alloy metal.
  - 2. Interior Locations:
    - a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) to following items:
      - 1) Metal under 94 degrees C (200 degrees F) of items such as bare piping, fittings, hangers and supports.
      - 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
      - 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
    - c. Apply one coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) on finish of insulation on boiler breeching and uptakes inside boiler house, drums, drumheads, oil heaters, feed water heaters, tanks and piping.
    - d. Paint electrical conduits containing cables rated 600 volts or more using two coats of MPI 9 (Exterior Alkyd Enamel (EO in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.
  - 3. Other exposed locations:
    - a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two coats of MPI 1 (Aluminum Paint (AP)).
    - b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 11 (Exterior Latex Semi-Gloss (AE))

**3.11 BUILDING AND STRUCTURAL WORK FIELD PAINTING**

- A. Painting and finishing of interior and exterior work except as specified under paragraph 3.11 B.
  - 1. Painting and finishing of new work including colors and gloss of finish selected is specified in Finish Schedule, Section 09 06 00, SCHEDULE FOR FINISHES.
  - 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
  - 3. Painting of ferrous metal and galvanized metal.
  - 4. Identity painting and safety painting.
- B. Building and Structural Work not Painted:
  - 1. Prefinished items:
    - a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.

**SECTION 09 91 00**  
**PAINTING**

**3.11 BUILDING AND STRUCTURAL WORK FIELD PAINTING (Cont)**

- b. Factory finished equipment.
- 2. Finished surfaces:
  - a. Hardware except ferrous metal.
  - b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
  - c. Signs, fixtures, and other similar items integrally finished.
- 3. Concealed surfaces:
  - a. Inside duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
  - b. Inside walls or other spaces behind access doors or panels.
  - c. Surfaces concealed behind permanently installed casework and equipment.
- 4. Moving and operating parts:
  - a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
  - b. Tracks for overhead or coiling doors, shutters, and grilles.
- 5. Labels:
  - a. Code required label, such as Underwriters Laboratories Inc., Inchcape Testing Services, Inc., or Factory Mutual Research Corporation.
  - b. Identification plates, instruction plates, performance rating, and nomenclature.
- 6. Galvanized metal:
  - a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
  - c. Except where specifically specified to be painted.
- 7. Metal safety treads and nosings.
- 8. Gaskets.
- 9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
- 10. Face brick.
- 11. Structural steel encased in concrete, masonry, or other enclosure.
- 12. Structural steel to receive sprayed-on fire proofing.
- 13. Ceilings, walls, columns in interstitial spaces.
- 14. Ceilings, walls, and columns in pipe basements.
- 15. Wood Shingles.

**3.12 IDENTITY PAINTING SCHEDULE**

- A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.
  - 1. Legend may be identified using 2.1 G options or by stencil applications.
  - 2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12 000 mm (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
  - 3. Locate Legends clearly visible from operating position.
  - 4. Use arrow to indicate direction of flow.

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**3.12 IDENTITY PAINTING SCHEDULE (CONT)**

5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
  - a. High Pressure - 414 kPa (60 psig) and above.
  - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
  - c. Low Pressure - 103 kPa (14 psig) and below.
  - d. Add Fuel oil grade numbers.
6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Blow-off		Yellow	Black	Blow-off
Boiler Feedwater		Yellow	Black	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr Sup
A/C Condenser Water Return		Green	White	A/C Cond Wtr Ret
Chilled Water Supply		Green	White	Ch. Wtr Sup
Chilled Water Return		Green	White	Ch. Wtr Ret
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Yellow	Black	H.P. _____*
High Pressure Condensate Return		Yellow	Black	H.P. Ret _____*
Medium Pressure Steam		Yellow	Black	M. P. Stm _____*
Medium Pressure Condensate Return		Yellow	Black	M.P. Ret _____*
Low Pressure Steam		Yellow	Black	L.P. Stm _____*
Low Pressure Condensate Return		Yellow	Black	L.P. Ret _____*
High Temperature Water Supply		Yellow	Black	H. Temp Wtr Sup
High Temperature Water Return		Yellow	Black	H. Temp Wtr Ret
Hot Water Heating Supply		Yellow	Black	H. W. Htg Sup
Hot Water Heating Return		Yellow	Black	H. W. Htg Ret
Gravity Condensate Return		Yellow	Black	Gravity Cond Ret
Pumped Condensate Return		Yellow	Black	Pumped Cond Ret
Vacuum Condensate Return		Yellow	Black	Vac Cond Ret
Fuel Oil - Grade		Green	White	Fuel Oil-Grade ____*



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PAINTING**

Boiler Water Sampling		Yellow	Black	Sample
Continuous Blow-Down		Yellow	Black	Cont. B D
Pumped Condensate		Black		Pump Cond
Pump Recirculating		Yellow	Black	Pump-Recirc.
Vent Line		Yellow	Black	Vent
Alkali		Yellow	Black	Alk
Bleach		Yellow	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic) Dom		White	Green	White C.W.
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Reagent Grade Water		Green	White	RG
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler		Red	White	Auto Spr
Standpipe		Red	White	Stand
Sprinkler		Red	White	Drain
Hot Water Supply Domestic/Solar Water	H.W. Sup Dom/SW			
Hot Water Return Domestic/Solar Water	H.W. Ret Dom/SW			

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6100 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, 5000 .

**SECTION 09 91 00  
PAINTING**

**3.12 IDENTITY PAINTING SCHEDULE (CONT)**

**B. Fire and Smoke Partitions:**

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE BARRIER" or "FIRE BARRIER" as applicable.
3. Locate not more than 6100 mm (20 feet) on center on corridor sides of partitions, and with a least one message per room on room side of partition.
4. Use semigloss paint of color that contrasts with color of substrate.

**3.14 PROTECTION CLEAN UP, AND TOUCH-UP**

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

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**APPENDIX**

Coordinate the following abbreviations used in Section 09 91 00, PAINTING, with other Sections, especially Section 09 06 00, SCHEDULE FOR FINISHES and other COATING SECTIONS listed. Use the same abbreviation and terms consistently.

Paint or coating	Abbreviation
Acrylic Emulsion	AE (MPI 10 - flat/MPI 11 - semigloss/MPI 119 - gloss)
Alkyd Flat	Ak (MPI 49)
Alkyd Gloss Enamel	G (MPI 48)
Alkyd Semigloss Enamel	SG (MPI 47)
Aluminum Paint	AP (MPI 1)
Exterior Latex	EL??(MPI 10 / 11 / 119)??
Epoxy Coating	EC (MPI 77 - walls, floors/MPI 108 - CMU, concrete)
Latex Emulsion	LE (MPI 53, flat/MPI 52, eggshell/MPI 54, semigloss/MPI 114, gloss Level 6)
Latex Flat	LF (MPI 138)
Latex Gloss	LG (MPI 114)
Latex Semigloss	SG (MPI 141)
Latex Low Luster	LL (MPI 139)
Polyurethane Varnish	PV (MPI 31 - gloss/MPI 71 - flat)
Wood Stain	WS (MPI 90)

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**SECTION 09 94 19**  
**MULTICOLOR INTERIOR FINISHING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A water or solvent based multicolored coating that is sprayed over primed interior surfaces to obtain a decorative polychromatic finish.

**1.2 RELATED WORK**

- A. Location and color and texture of finish coat: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Painting: Section 09 91 00, PAINTING.
- C. Gypsum Board: Section 09 29 00, GYPSUM BOARD.

**1.3 QUALITY ASSURANCE**

- A. Use only qualified trained applicators for mixing and application of coating.
- B. Coverage and hide shall be complete. When color, stain, dirt, or undercoats show through final coat of multi-color coating, the surface shall be covered by additional coats until the coating film is of uniform finish, color appearance, and coverage.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Material samples, 150 mm (six inches) square, showing the number of coats of coating material on each substrate to which the material is to be applied. Apply coating to the samples in a setback procedure, leaving exposed a portion of the substrate and subsequent portions of each coat.
  - 2. Color samples, minimum 75 mm by 125 mm (three inches by five inches), of each color s specified.
- C. Certificates:
  - 1. Letter of certification from the manufacturer stating that the applicator is approved for the multi-color coating material furnished.
  - 2. Letter of certification stating the technicians to be utilized for the application of the multi-color coating material have been trained by the coating manufacturer.  
Certification shall include statement that specialized equipment as required by the coating manufacturer will be used in the application of the multi-color coating.
- D. Manufacturer's Literature and Data:
  - 1. Literature and data describing the coating material to be furnished.

**SECTION 09 94 19**  
**MULTICOLOR INTERIOR FINISHING**

2. Printed application instructions for each substrate.

**1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products in original containers, (seals unbroken) bearing factory-applied labels intact.
- B. Store materials in one location designated by the Resident Engineer. Keep storage area clean, orderly, and well ventilated. Keep all waste and rags in metal containers, tightly covered, and safely dispose of at the end of each working day. Observe all precautions to avoid danger of fire. Provide approved type fire extinguishers immediately outside storage area. Maintain temperature in storage areas, at no less than 10°C (50 degrees F).

**1.6 JOB CONDITIONS AND COORDINATION**

- A. Do not apply coating materials when temperature is below 10°C (50 degrees F). In order to prevent mildew, and improper drying of coating, provide adequate ventilation for escape of moisture from building. Once application has commenced, prevent wide variation of temperatures which might result in condensation on freshly coated surfaces.
- B. Before application is started in any area, broom clean and remove excessive dust.
- C. After application operations have begun in a given area, broom cleaning is prohibited; clean only with commercial vacuum cleaning equipment.
- D. Adequate illumination shall be provided in all areas where application operations are in progress.
- E. This work shall be scheduled and coordinated with other trades and shall not proceed until other work and job conditions are as required to achieve satisfactory results.
- F. Multi-color coating application shall be completed prior to installation of mechanical and electrical device cover plates.

**1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. The Master Painters Institute (MPI):  
Approved Product List – March 2010
- C. American Society for Testing and Materials (ASTM):  
E84-09.....Surface Burning Characteristics of Building Materials

**SECTION 09 94 19**  
**MULTICOLOR INTERIOR FINISHING**

**PART 2 - PRODUCTS**

**2.1 MULTI-COLORED COATING**

- A. Low odor, Class A Fire rated and listed per ASTM E84, bacteriostatic per MPI No. 112, plastic terpolymer coating, incorporating a high resistance to fungus, mildew, alkalinity, soil and abrasion.
- B. All materials shall be used only as specified by manufacturer's direction label on the container or other technical publications.
- C. Primer shall be approved MPI No. 125. These shall bear identifying labels on the containers. Thinners, if necessary, shall only be those as recommended by the manufacturer for the material being thinned.
- D. All coating materials and equipment shall be compatible in use; finish coats shall be compatible with foundation coatings, overcoatings and the surfaces to be coated; all tools and equipment shall be compatible with the coating to be applied.
- E. Provide ready mixed multi-color coating materials. Job tinting and mixing is not acceptable.

**PART 3 - EXECUTION**

**3.1 INSPECTION AND ACCEPTANCE OF SURFACES**

- A. Follow manufacturer's instructions carefully so as to apply materials only to surfaces which are acceptable.
- B. Before starting any work, surfaces to receive multi-color coatings shall be examined carefully for defects which cannot be corrected by the procedures specified under Article, PREPARATION OF SURFACES and which might prevent satisfactory results. Work shall not proceed until defects are corrected.
- C. Application of coating materials shall constitute acceptance of the surface, and shall obligate Contractor for such repair as are necessary to repair any unsatisfactory finish resulting.

**3.2 PREPARATION OF SURFACES**

- A. Prior to surface preparation and application operations, completely mask, remove, or otherwise adequately protect hardware, accessories, machined surfaces, plates, lighting fixtures, and similar items not scheduled to receive multi-color coating.
- B. Before applying multi-color coating, thoroughly clean all surfaces involved. Schedule cleaning so that dust and other contaminants from the cleaning process do not fall on wet, newly coated surfaces.

**SECTION 09 94 19**  
**MULTICOLOR INTERIOR FINISHING**

- C. All surfaces shall be clean, dry and adequately protected from dampness. Surfaces shall be smooth, even, and true to plane, and free of any foreign material which will adversely affect adhesion or appearance of applied coating.
- D. Mildew shall be removed and neutralized.
- E. Before coating is applied, surfaces shall be tested with moisture-testing device. No coating shall be applied when moisture content exceeds 12 percent except as may be required by the manufacturer of the coating materials used. Test sufficient area in each space, and as often as necessary to determine the proper moisture content for application.
- F. Prime surfaces to receive multi-color coating with primer recommended by coating manufacturer. Use stark white primer. No top coating will be allowed if primer is any other color than stark white.
- G. Sand and reprime all abrasions and damaged spots in the surface of the prime coat before proceeding with subsequent finish coat.

**3.3 APPLICATION**

- A. Follow manufacturer's printed recommendations and instructions in application of multi-color coating materials.
- B. Apply multi-color coating material by using high velocity, pressure differential spray technique, with variable control to assure uniform distribution and 100 percent full coat (continuous) coverage.
- C. Equipment shall be kept clean and in proper condition to provide best quality work.
- D. Evenly spread and smoothly apply materials free of runs, sags, holidays, lap marks, air bubbles, and pin holes to assure a smooth finish.
- E. Suction or hot spots shall be touched up.
- F. Finish material shall be applied in one coat over properly primed surfaces according to manufacturer's instructions and as required to meet specified requirements for sheen, texture and color.
- G. Should any coat of coating be adjudged unsatisfactory, it shall be sandpapered or removed and additional coats applied as necessary until satisfactory finish is achieved.
- H. Finish coat shall be MPI No. 121, clear top coat for multicolored coatings. Apply per manufacturers' instructions.

**SECTION 09 94 19**  
**MULTICOLOR INTERIOR FINISHING**

**3.4 PROTECTION AND CLEAN UP**

- A. Protect the adjacent work and materials by suitable covering or other method, during application of the textured coating. Upon completion of the work, remove all coating material spots from the floors, glass and other surfaces. Remove from the premises all rubbish and accumulated materials and leave the work in clean, orderly and acceptable condition.
- B. Contractor shall repair and recoat damaged surfaces. Repair and recoat damaged surfaces at no additional expense to the Government.

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**SECTION 09 96 59**  
**HIGH-BUILD GLAZED COATINGS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies a special coating (SC) system designed to provide on interior masonry or other surfaces a glazed tile like finish.

**1.2 RELATED WORK**

Location, color and texture (Class): Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Material samples, 150 mm (six inches) square, showing the number of coats of each coating material on each substrate to which the material is to be applied. Apply coating to the samples in a setback procedure, leaving exposed a portion of the substrate and subsequent portions of each coat.
  - 2. Color samples, minimum 75 mm (three inches) by 125 mm (five inches) of each color and texture (Class) specified.
- C. Certificates:
  - 1. Certifying that the coating complies with requirements of this specification, including resistance to abrasion and resistance to perspiration.
- D. Manufacturer's Literature and Data:

Literature and data describing the coating material to be furnished. Printed application for instructions for each substrate.

**1.4 ENVIRONMENTAL REQUIREMENTS**

Apply coating only when surface and air ambient temperature is above 10°C (50 degrees F) and maintained for a period of not less than 48 hours after applications, except as otherwise required by the coating manufacturer.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The Master Painters Institute (MPI): Approved Product List – 2010

**SECTION 09 96 59**  
**HIGH-BUILD GLAZED COATINGS**

**PART 2 - PRODUCTS**

**2.1 HIGH-BUILD COATING**

- A. Penetrating coating: solvent-free sioxane based water repellent for lime and cement based coatings.
  - 1. Unaffected by UV light
  - 2. Inhibits growth of mold and algae and resistant to alkali
  - 3. Protection against freeze-thaw and efflorescence.
- B. Sealer/Primer: finely aggregated opaque water-based sealer/primer for adhesion
  - 1. Low odor, zero VOC's ASTM D6886
  - 2. Low splatter, 50% solids
  - 3. 1.35g/ml density
- C. System: 0.1-0.3 mm thick, Base color 1 coat plus 2 coats minimum finish

**PART 3 - EXECUTION**

**3.1 PREPARATION OF SURFACES**

- A. Patch surfaces as required for receiving glazed coating. Fill masonry block and make surfaces smooth and free of voids and pinholes. Assure surfaces are clean, dry, well cured, sound and free of ridges and depressions.
- B. Remove or protect items not requiring coating.

**3.2 APPLICATION**

- A. Finish Film Thickness: Not less than the manufacturer's recommended spreading rate.
- D. In rooms or spaces shown or specified to have coating, apply the coating to surfaces behind casework and equipment, except behind those items built into wall recesses.
- E. Make edges of coatings sharp and clean without overlapping other materials or colors.
- F. Apply coating in areas specified under Section 09 06 00, SCHEDULE FOR FINISHES.

**3.3 CLEANING AND PROTECTION**

- A. During progress of the work and upon completion, promptly clean adjacent surfaces and materials of spills, spatters, drips, and stains from glazed coatings application. Remove glazed coatings by proper methods exercising care to prevent damage to finished surfaces and materials.
- B. Protect work of other trades against damage resulting from glazed coatings work.
- C. Touch up damaged coating surfaces before final acceptance.

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**SECTION 10 14 00**  
**SIGNAGE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies interior signage for room numbers, directional signs, code required signs, telephone identification signs and temporary interior signs.
- B. This section also specifies exterior medical center identification signs, building identification signs, parking and traffic signs.
- C. Installation of Government furnished dedication plaque and VA seal.

**1.2 RELATED WORK**

- B. Lighted EXIT signs for egress purposes are specified under Division 26, ELECTRICAL.
- D. Color Finish: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 MANUFACTURER'S QUALIFICATIONS**

Sign manufacturer shall provide evidence that they regularly and presently manufactures signs similar to those specified in this section as one of their principal products.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples: Sign panels and frames, with letters and symbols, each type. Submit 3sets. One set of samples will be retained by each Resident Engineer, Architect and the, other returned to Contractor.
  - 1. Sign Panel, 200 mm x 250 mm (8 inches x 10 inches), with letters.
  - 2. Color samples of each color, 150 mm x 150 mm (6 inches x 6 inches. Show anticipated range of color and texture.
  - 3. Sample of typeface, arrow and symbols in a typical full size layout.
- C. Manufacturer's Literature:
  - 1. Showing the methods and procedures proposed for the concealed anchorage of the signage system to each surface type.
  - 2. Manufacturer's printed specifications, anchorage details, installation and maintenance instructions.
- D. Samples: Sign location plan, showing location, type and total number of signs required.
- E. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.
- F. Full size layout patterns for dimensional letters.

**1.5 DELIVERY AND STORAGE**

- A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.
- B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.
- C. Deliver signs only when the site and mounting services are ready for installation work to proceed.
- D. Store products in dry condition inside enclosed facilities.

**SECTION 10 14 00  
SIGNAGE**

**1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate
  - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Shapes, and tubes.
- C. Federal Specifications (Fed Spec):
  - MIL-PRF-8184F.....Plastic Sheet, Acrylic, Modified.
  - MIL-P-46144C.....Plastic Sheet, Polycarbonate

**1.7 MINIMUM SIGN REQUIREMENTS**

- A. [www.cfm.va.gov/til/signs/signage.pdf](http://www.cfm.va.gov/til/signs/signage.pdf)
- B. [www.cfm.va.gov/til/signs/signage02a.pdf](http://www.cfm.va.gov/til/signs/signage02a.pdf)
- C. [www.cfm.va.gov/til/signs/signage02b.pdf](http://www.cfm.va.gov/til/signs/signage02b.pdf)

**1.8 COLORS AND FINISHES:**

Schedule in Appendix.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Signs of type, size and design shown on the drawings and as specified in Schedule in Appendix.
- B. Signs complete with lettering, framing and related components for a complete installation.
- C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- D. Do not scale drawings for dimensions. Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. Resident Engineer to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.
- E. The Sign Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Contractor shall further warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

**2.2 PRODUCTS**

- A. Vinyl: 0.1 mm thick machine cut, having a pressure sensitive adhesive and integral colors.

**2.3 SIGN STANDARDS AND TYPES**

- A. See Schedule in Appendix for listing of all signs and their Type.
- B. Standards for signage compliance: [www.cfm.va.gov/til/signs/signage.pdf](http://www.cfm.va.gov/til/signs/signage.pdf)

**SECTION 10 14 00**  
**SIGNAGE**

**2.4 FABRICATION**

- A. Design components to allow for expansion and contraction for a minimum material temperature range of 56 °C (100 °F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.
- B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- D. Contact surfaces of connected members be true. Assembled so joints will be tight and practically unnoticeable, without use of filling compound.
- E. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces be smooth flat and without oil-canning, free of rack and twist. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.
- F. Level or straighten wrought work. Members shall have sharp lines and angles and smooth surfaces.
- G. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
- H. Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.
- I. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints tightly mitered to give appearance of solid material.
- J. All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.
- K. Movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of members. Doors and covers centered in opening or frame. All contact surfaces fit tight and even without forcing or warping components.
- L. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
- M. No signs are to be manufactured until final sign message schedule and location review has been completed by the Resident Engineer & forwarded to contractor.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction and finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.
- B. Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and sign location drawings. Where otherwise not dimensioned, signs shall be installed where best suited to provide a consistent appearance throughout the project. When exact position, angle, height or location is in doubt, contact Resident Engineer for clarification.

**SECTION 10 14 00  
SIGNAGE**

**3.1 INSTALLATION (CONT)**

- C. Contractor shall be responsible for all signs that are damaged, lost or stolen while materials are on the job site and up until the completion and final acceptance of the job.
- D. Remove or correct signs or installation work Resident Engineer determines as unsafe or as an unsafe condition.
- E. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.
- F. Locate signs as shown on the Sign Location Plans.
- G. Certain signs may be installed on glass. A blank glass back up is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.
- H. Contractor will be responsible for verifying that behind each sign location there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.
- I. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices which may involve other trades.

INTERIOR SIGNAGE SCHEDULE FOLLOWS.

--- END ---

SECTION 10 14 00  
SIGNAGE

	A	B	C	D
1	<b>Door #</b>	<b>Door Side</b>	<b>VA</b>	<b>Proposed</b>
2	<b>Sign Location</b>	<b>Push or Pull</b>	<b>Sign type</b>	<b>Sign text</b>
48	D104A	Pull	IN-04.02	Seclusion West
49	D104B	Pull	IN-04.02	Seclusion West
50	D106A	Pull	IN-04.02	Seclusion East
51	D106B	Pull	IN-04.02	Seclusion East
52	E101	Pull	IN-04.02	Authorized Personnel Only
53	E102	Push	IN-04.02	Staff Toilet
54	E103	Pull	IN-04.02	IDF
55	E105	Push	IN-04.02	Nurse manager
56	E106	Push	IN-04.02	Office
57	E107	Push	IN-04.02	Office
58	E108	Push	IN-04.02	Office
59	E109	Push	IN-04.02	Office
60	E 110	Pull	IN-04.02	Staff Only
61	E113	Pull	IN-04.02	Staff Shower
62	E114A	Push	IN-04.02	Storage
63	E114B	Push	IN-04.02	Storage
64	E115	Push	IN-04.02	Office
65	E116A	Pull	Ext	Staff Only
66	E118	Push	IN-04.02	Restroom/symbols
67	E117	Pull	IN-04.02	Authorized Personnel Only
68	E119	Push	IN-04.02	Conference Room
69	E120A	Push	IN-04.02	Staff Lounge
70	E121	Pull	Ext	Medical Gas/symbols
71	E122A	Push	IN-08.01	Mechanical Room/ Authorized Personnel Only
72	E122B	Pull	Ext	Mechanical Room
73	E123A	Pull	IN-04.02	Electrical Room
74	E123B	Pull	Ext	Electrical Room
75	E124	Pull	IN-04.02	MDF Room
76	E125	Pull	IN-04.02	Environmental Services
77	E126	Push	IN-04.02	Clean Linen
78	E127	Push	IN-04.02	Clean Linen
79	E128	Push	IN-04.02	Soiled Linen
80				
	Note: Main Interior Sign color to be VA Color # B5 with text in Antique White B18.			
81	Submit samples for approval			
82	* Install on glass if necessary/instructed			
83				

SECTION 10 14 00  
SIGNAGE

	A	B	C	D
1	Door #	Door Side	VA	Proposed
2	Sign Location	Push or Pull	Sign type	Sign text
3	A101-A	Pull	Ext	VA Acute Psych Ward
4	A101-B	Pull	Ext	VA Acute Psych Ward
5	A104	Pull	IN-09.01	Restroom/symbols
6	A106-A	Pull	IN-04.02	Public Visit
7	A106-A	Push	IN-04.02	To Lobby
8	A106-B	Push	IN-04.02	No Visitors
9	B101	Wall	IN-04.02	Reception
10	B101	Push	IN-04.02	Ward Clerk
11	B103	Pull	IN-04.02	Clean Linen
12	B107	Push	IN-04.02	Authorized Personnel Only
13	B104	Pull	IN-04.02	Housekeeping
14	B106	Pull	IN-04.02	Pharmacy
15	B106	Wall	IN-04.02	Pharmacy
16	B109	Push	IN-04.02	Staff Only
17	B110	Push	IN-04.02	Storage
18	C101	Pull	IN-04.02	Authorized Personnel Only
19	C101	Push	IN-04.02	Staff Only
20	C102A	Push	IN-04.02	Medical treatment
21	C102B	Push	IN-04.02	Medical treatment
22	C103	Pull	IN-04.02	Intake
23	C108	Pull	IN-04.02	Room 101
24	C110	Pull	IN-04.02	Room 102
25	C112	Pull	IN-04.02	Room 103
26	C114	Pull	IN-04.02	Room 104
27	C116	Pull	IN-04.02	Room 105
28	C118	Pull	IN-04.02	Room 106
29	C120A	Pull	IN-04.02	Consult
30	C120B	Pull *	IN-04.02	Electrical Panel
31	C121A	Pull *	IN-04.02	Group Room
32	C121B	Pull *	IN-04.02	Group Room
33	C123A	Pull	IN-04.02	Dining Room
34	C123B	Pull	IN-04.02	AV & Craft Storage
35	C124	Push	Ext	No Exit
36	C126	Pull	IN-04.02	Room 107
37	C128	Pull	IN-04.02	Room 108
38	C130	Pull	IN-04.02	Room 109
39	C132	Pull	IN-04.02	Room 110
40	C134	Pull	IN-04.02	Authorized Personnel Only
41	C134	Push	IN-04.02	Staff Only
42	C135	Pull	IN-04.02	Restroom/symbols
43	C136	Pull	IN-04.02	Quiet Room
44	C137	Wall	IN-04.02	Nutrition
45	C138	Wall	IN-04.02	Food Carts
46	D101-A	Push	Ext	VA Acute Physch Ward, Seclusion Vestibule
47	D103	Pull	IN-04.02	Seclusion



**SECTION 10 26 00  
WALL AND DOOR PROTECTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies wall guards (crash rails or bumper guards), corner guards and door/door frame protectors.

**1.2 RELATED WORK**

- A. Armor plates and kick plates not specified in this section: Section 08 71 00, DOOR HARDWARE.
- B. Color and texture of aluminum and resilient material: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design and installation details.
- C. Manufacturer's Literature and Data:
  - 1. Wall Guards.
  - 2. Corner Guards.
  - 3. Door/Door Frame Protectors.
- D. Test Report: Showing that resilient material complies with specified fire and safety code requirements.

**1.4 DELIVERY AND STORAGE**

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.
- B. Protect from damage from handling and construction operations before, during and after installation.
- C. Store in a dry environment of approximately 21° C (70 degrees F) for at least 48 hours prior to installation.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - B221-08..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - D256-06..... Impact Resistance of Plastics
  - D635-06..... Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
  - E84-09..... Surface Burning Characteristics of Building Materials
- C. National Fire Protection Association (NFPA):
  - 80-10..... Standard for Fire Doors and Windows
- D. Society of American Automotive Engineers (SAE):
  - J 1545-05..... Instrumental Color Difference Measurement for Exterior Finishes.
- E. Underwriters Laboratories Inc. (UL):
  - Annual Issue ..... Building Materials Directory

**SECTION 10 26 00**  
**WALL AND DOOR PROTECTION**

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

A. Resilient Material:

1. Extruded and injection molded acrylic vinyl or extruded polyvinyl chloride meeting following requirements:
  - a. Minimum impact resistance of 1197 ps (25 ft lbs per sq.ft) when tested in accordance with ASTM D256 (Izod impact, ft.lbs. per inch notch).
  - b. Class 1 fire rating when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less.
  - c. Rated self extinguishing when tested in accordance with ASTM D635.
  - d. Material shall be labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.
  - e. Integral color with all colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.
  - f. Same finish on exposed surfaces.

B. Design Basis : Acrovyn

**2.2 CORNER GUARDS**

A. Resilient, Shock-Absorbing Corner Guards: Flush mounted type of 30 mm (1-1/4 inch radius) formed to profile shown.

1. Snap-on corner guard formed from resilient material, minimum 2 mm (0.078-inch) thick, free floating on a continuous 1.6 mm (0.063-inch) thick extruded aluminum retainer. Design retainer used for flush mounted type to act as a stop for adjacent wall finish material. Provide appropriate mounting hardware, cushions and base plates as required.
2. Provide factory fabricated end closure caps at top and bottom of surface mounted corner guards.
3. Flush mounted corner guards installed on any fire rated wall shall maintain the fire rating of the wall. Provide fire test of proposed corner guard system to verify compliance.
  - a. Where insulating materials are an integral part of the corner guard system, the insulating materials shall be provided by the manufacturer of the corner guard system.
  - b. All exposed metal in fire rated assemblies shall have a paintable finish.

**2.3 WALL GUARDS**

A. Resilient Wall Guards:

1. Wall Guards (Crash Rails): Snap-on covers of resilient material, minimum 2.8 mm (0.110-inch) thick, shall be free-floated over 50 mm (two-inch) wide aluminum retainer clips, minimum 2.3 mm (0.090-inch) thick, anchored to wall at maximum 600 mm (24 inches) on center, supporting a continuous aluminum retainer, minimum 1.6 mm (0.062-inch) thick; or, shall be free-floated over a continuous extruded aluminum retainer, minimum 2.3 (0.090-inch) thick anchored to wall at maximum 600 mm (24 inches) on center.
2. Provide wall guards (crash rails) with prefabricated and closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories as required. End caps and corners shall be field adjustable to assure close alignment with handrails and wall guards (crash rails). Screw or bolt closure caps to aluminum retainer.

**SECTION 10 26 00  
WALL AND DOOR PROTECTION**

**2.4 DOOR AND DOOR FRAME PROTECTION**

- A. Fabricate door and door frame protection items from vinyl acrylic or polyvinyl chloride resilient material, minimum 1.5 mm (0.060-inch) thick, for doors and 0.9 mm (0.035-inch) thick for door frames, as shown.
- B. Coordinate door and door frame protection material requirements with door and frame suppliers to insure fit for all components, and color as specified.
- C. Provide adhesive as recommended by resilient material manufacturer.
- D. Kick/ Push plate material supplied precut to size with beveled edges.
  - 1. Material nominal 0.04 "is minimum.

**2.6 FASTENERS AND ANCHORS**

- A. Provide fasteners and anchors as required for each specific type of installation.
- B. Where type, size, spacing or method of fastening is not shown or specified, submit shop drawings showing proposed installation details.

**2.7 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Resilient Material: Embossed texture and color in accordance with SAE J 1545 and as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

**PART 3 - INSTALLATION**

**3.1 RESILIENT CORNER GUARDS**

Install corner guards on walls in accordance with manufacturer's instructions.

**3.2 STAINLESS STEEL CORNER GUARDS**

Mount guards on external corners of interior walls, partitions and columns as shown.

- A. Where corner guards are installed on walls, anchor corner guards as shown on drawings.
  - 1. Recess as shown and attach to framing with base aluminum retainer clip.
  - 2. Where corner guards are installed on gypsum board, clean surface and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from around edge of guard and allow to cure undisturbed for 24 hours.

**3.3 RESILIENT WALL GUARDS (CRASH RAIL)**

Secure guards to walls with mounting cushions and fasteners in accordance with manufacturer's details and instructions.

**3.4 DOOR, DOOR FRAME PROTECTION AND HIGH IMPACT WALL COVERING**

- A. Surfaces to receive protection shall be clean, smooth and free of obstructions.
- B. Install protectors after frames are in place but preceding installation of doors in accordance with approved shop drawings and manufacturers specific instructions.
- C. Apply with adhesive in controlled environment according to manufacture's recommendations.

**SECTION 10 26 00  
WALL AND DOOR PROTECTION**

**3.4 DOOR, DOOR FRAME PROTECTION AND HIGH IMPACT WALL COVERING (CONT)**

- D. Protection installed on fire rated doors and frames shall be installed according to NFPA 80 and installation procedures listed in UL Building Materials Directory; or, equal listing by other approved independent testing laboratory establishing the procedures.

- - - E N D - - -

**SECTION 10 28 00**  
**TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies manufactured items usually used in toilets, baths, locker rooms and at sinks in related spaces.
- B. Items Specified:
  - 1. Paper towel dispenser.
  - 2. Combination paper towel dispenser and disposal unit.
  - 3. Waste receptacles.
  - 4. Toilet tissue dispenser.
  - 5. Grab Bars: (10800-1.DWG).
  - 6. Shower curtain rods: (10800-2.DWG) and (10800-3.DWG).
  - 7. Clothes hooks, robe or coat.
  - 8. Towel bars.
  - 9. Metal framed mirror: (10800-7.DWG).
  - 10. Medicine cabinet.
  - 11. Soap dishes.
  - 12. Paper cup dispenser.
  - 13. Mop racks.
- B. This section also specifies custom fabricated items used in toilets and related spaces.

**1.2 RELATED WORK**

- A. Color of finishes: Section 09 06 00, SCHEDULE FOR FINISHES

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each product specified.
  - 2. Paper towel dispenser and combination dispenser and disposal units.
  - 3. Metal framed mirrors, showing shelf where required, fillers, and design and installation of units when installed on ceramic tile wainscots and offset surfaces.
  - 4. Shower Curtain rods, showing required length for each location.
  - 5. Grab bars, showing design and each different type of anchorage.
  - 6. Show material and finish, size of members, and details of construction, installation and anchorage of mop racks.
- C. Samples:
  - 1. One of each type of accessory specified.
  - 2. After approval, samples may be used in the work.
- D. Manufacturer's Literature and Data:
  - 1. All accessories specified.
  - 2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
  - 3. Show working operations of spindle for toilet tissue dispensers.
  - 4. Mop racks.

**SECTION 10 28 00  
TOILET, BATH, AND LAUNDRY ACCESSORIES**

**1.3 SUBMITTALS (CONT)**

- E. Manufacturer's Certificates:
  - 1. Attesting that soap dispensers are fabricated of material that will not be affected by liquid soap or aseptic detergents, PhisoHex and solutions containing hexachlorophene.
  - 2. Anodized finish as specified.

**1.4 QUALITY ASSURANCE**

- A. Each product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be assembled to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

**1.5 PACKAGING AND DELIVERY**

- A. Pack accessories individually to protect finish.
- B. Deliver accessories to the project only when installation work in rooms is ready to receive them.
- C. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- D. Deliver products to site in sealed packages of containers; labeled for identification with manufacturer's name, brand, and contents.

**1.6 STORAGE**

- A. Store products in weathertight and dry storage facility.
- B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
  - A176-99(R2009).....Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
  - A269-10.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service
  - A312/ A312M-09.....Seamless and Welded Austenitic Stainless Steel Pipes
  - A653/ A653M-10.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

**SECTION 10 28 00  
TOILET, BATH, AND LAUNDRY ACCESSORIES**

- B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Shapes, and Tubes
- B456-03(R2009) .....Electrodeposited Coatings of Copper Plus Nickel Plus  
Chromium and Nickel Plus Chromium
- D635-10.....Rate of Burning and/or Extent and Time of Burning of Self  
Supporting Plastics in a Horizontal Position
- F446-85(R2009) .....Consumer Safety Specification for Grab Bars and  
Accessories Installed in the Bathing Area.
- C. The National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500 Series.....Metal Finishes Manual
- D. American Welding Society (AWS):  
D10.4-86 (R2000).....Welding Austenitic Chromium-Nickel Stainless Steel  
Piping and Tubing
- E. Federal Specifications (Fed. Specs.):  
A-A-3002 .....Mirrors, Glass  
FF-S-107C (2).....Screw, Tapping and Drive  
FF-S-107C .....Screw, Tapping and Drive.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Aluminum: ASTM B221, alloy 6063-T5 and alloy 6463-T5.
- B. Stainless Steel:
  - 1. Plate or sheet: ASTM A167, Type 302, 304, or 304L, except ASTM A176 where Type 430 is specified, 0.0299-inch thick unless otherwise specified.
  - 2. Tube: ASTM A269, Alloy Type 302, 304, or 304L.
- C. Stainless Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or welded.
- D. Stainless Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.
- E. Glass:
  - 1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors, and for mirror doors in medicine cabinets.
  - 2. ASTM C1036, Type 1 Class 1 Quality q3, for shelves in medicine cabinets.
  - 3. ASTM C1048, Kind FT, Condition A, Type 1, Class 1 (use in Mental Health and Behavior Nursing Unit Psychiatric Patient Areas and Security Examination Rooms where mirrors and glass are specified).

**2.2 FASTENERS**

- A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface, tamper resistant and flush mounted
- B. Concealed Fasteners: Steel, hot-dip galvanized (except in high moisture areas such as showers or bath tubs use stainless steel).
- C. Toggle Bolts: For use in hollow masonry or frame construction.
- D. Hex bolts: For through bolting on thin panels.
- E. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.

**SECTION 10 28 00**  
**TOILET, BATH, AND LAUNDRY ACCESSORIES**

**2.2 FASTENERS (CONT)**

- F. Screws:
  - 1. ASME B18.6.4.
  - 2. Fed Spec. FF-S-107, Stainless steel Type A.
- G. Adhesive: As recommended by manufacturer for products to be joined.

**2.3 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Anodized Aluminum:
  - 1. AA-C22A41 Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick.
- C. AA-M32 Mechanical finish, medium satin.
  - 1. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
  - 2. Stainless Steel: NAAMM AMP 503, finish number 4.
  - 3. Ferrous Metal:
    - a. Shop Prime: Clean, pretreat and apply one coat of primer and bake.
    - b. Finish: Over primer apply two coats of alkyd or phenolic resin enamel, and bake.
  - 4. Nylon Coated Steel: Nylon coating powder formulated for a fluidized bonding process to steel to provide a hard smooth, medium gloss finish, not less than 0.3 mm (0.012-inch) thick, rated as self-extinguishing when tested in accordance with ASTM D635.

**2.4 FABRICATION - GENERAL**

- A. Welding, AWS D10.4.
- B. Grind dress, and finish welded joints to match finish of adjacent surface.
- C. Form exposed surfaces from one sheet of stock, free of joints.
- D. Provide steel anchors and components required for secure installation.
- E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.
- F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.
- G. Hot-dip galvanized steel, except stainless steel, anchors and fastening devices.
- H. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.
- I. Key items alike.
- J. Provide templates and rough-in measurements as required.
- K. Round and deburr edges of sheets to remove sharp edges.

**2.5 ACCESSORIES**

- A. Schedule of accessories is provided in Appendix of the Specification along with cuts for Design Basis.



**SECTION 10 28 00**  
**TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Before starting work notify Resident Engineer in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the Resident Engineer the exact location of accessories.

**3.2 INSTALLATION**

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Toggle bolt to steel anchorage plates in frame partitions or hollow masonry.
- C. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
- D. Install accessories plumb and level and securely anchor to substrate.
- E. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the performance of other devices.
- F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance as needed.
- G. Align mirrors, dispensers and other accessories even and level, when installed in battery.
- H. Install accessories to prevent striking by other moving, items or interference with accessibility.
- I. Install wall mirrors in Mental Health and Behavioral Units with tamper resistant screws that are flush mounted so that they will not support a rope or material for hanging.

**3.4 CLEANING**

After installation, clean as recommended by the manufacturer and protect from damage until completion of the project.

- - - E N D - - -



**SECTION 10 44 13  
FIRE EXTINGUISHER CABINETS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section covers recessed fire extinguisher cabinets.

**1.2 RELATED WORK**

- A. Acrylic glazing: Section 08 80 00, GLAZING.
- B. Field Painting: Section 09 91 00, PAINTING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

**1.4 APPLICATION PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced American Society of Testing and Materials (ASTM):  
D4802-10.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

**PART 2 - PRODUCTS**

**2.1 FIRE EXTINGUISHER CABINET**

Recessed type with flat trim of size and design shown.

**2.2 FABRICATION**

- A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.
- B. Fabricate door and trim from 1.2 mm (0.0478 inch) thick sheet steel with all face joints fully welded and ground smooth.
  - 1. Glaze doors with 6 mm (1/4 inch) thick ASTM D4802, clear acrylic sheet, Category B-1, Finish 1.
  - 2. Design doors to open 180 degrees.
  - 3. Provide continuous hinge, pull handle, and adjustable roller catch.

**2.3 FINISH**

- A. Finish interior of cabinet body with baked-on semigloss white enamel.
- B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

**PART 3 - EXECUTION**

- A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.
- B. Install cabinet so that bottom of cabinet is 975 mm (39 inches) above finished floor.

- - - E N D - - -



**SECTION 10 50 00  
LOCKERS & LOCKER ROOM BENCHES**

**PART 1 - GENERAL**

**1.1 SHOP DRAWINGS**

- A. Submit in accordance with Section 01330.
- B. Show dimensions, details of construction, joining of Equipment to adjacent Construction, Color, and other pertinent Items.

**1.2 COLOR SAMPLES**

- A. Prior to ordering and in accordance with Section 01330, submit

**1.3 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Manufacturer.

**1.4 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Deliver in Manufacturer's Protective Container with legible, identifying labels intact.
- B. Store flat and above ground.
- C. Protect against damage and discoloration.

**1.5 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 LOCKER DIMENSIONS**

- A. Locker Dimensions listed below are nominal, are for each Unit, and are exclusive of any Legs, Base, or Sloping Tops.
- B. Type: Double Tier See Drawings
- C. Height: 72 inches
  - 1. Per Locker: 36 inches
  - 2. Overall: 72 inches
- D. Width: 12 inches
- E. Depth: 12 inches
- F. Metal Thicknesses:
  - 1. Doors, Shelves, and any Exposed Tops: 16 ga.
  - 2. Exposed Ends, if any: 20 ga. (Outer Panel to conceal Fasteners, Fabrication Holes, etc. in Inner Panel.)
  - 3. Elsewhere: Manufacturer's standard.
- G. Finish:
  - 1. Material: Manufacturer's standard baked-on Enamel
- H. Color: See Color Schedule

**SECTION 10 50 00  
LOCKERS & LOCKER ROOM BENCHES**

**2.2 NUMBER PLATES**

- A. Material: Non-corrosive
- B. Numbering: Sequentially number each Locker starting in each Room with "1".

**2.3 ACCESSORIES**

- A. Required:
  - 1. Coat Hooks
  - 2. Ventilation Louvers in Doors
  - 3. Sloping Tops

**2.4 HARDWARE**

- A. Locker Lock Type: Built-in Combination Lock with integral, overriding Master Key.  
Door Hinges:
  - 1. Type: Manufacturer's standard
  - 2. Finish: Match adjacent Door Hardware specified in Section 08710
- B. Rubber Cushions: Provide for quiet Door operation.
- C. All Other: Manufacturer's standard type for conditions of use; provide all required.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that surfaces to receive Work of this Section are solid, true, square, plumb, accurately sized and located, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Install plumb, true, rattle-free, and with uniform joints.
- C. Fasten securely together and to adjacent Construction.

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 PRODUCT CLEANING & REPAIRING**

- A. Including Work of other Trades, clean, repair and touch-up, or replace when directed, Products which have been soiled, discolored, or damaged by Work of this Section.
- B. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**SECTION 10990  
MISCELLANEOUS SPECIALTIES**

**PART 1 - GENERAL**

**1.1 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.2 SHOP DRAWINGS**

- A. Show layout, dimensions, details of construction, methods of joining to other Work, required clearances, finishes, accessories, and other pertinent items.
- B. In accordance with Section 01330, submit for the following:
  - 1. Entry Mat
  - 2. Bicycle Racks
  - 3. Projection Screens

**1.3 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Deliver in Manufacturer's original, unopened, protective wrapping with original, legible label intact.

**1.4 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Manufacturer of Specialty being installed.

**PART 2 PRODUCTS**

**2.1 ENTRY MAT**

- A. Surface:
  - 1. Fiber: Solution Dyed polypropylene-polyester fiber from plastic bottles (100% recycled)
  - 2. Weight: 36 oz./sq. yd.
  - 3. Nub Height: 3/8"
- B. Backing:
  - 1. Type: SBR Rubber (15-20% recycled)
  - 2. Thickness: 3/8" nubs with 1/4" between nubs
  - 3. Durometer: 65
- C. Features:
  - 1. Indoor/Outdoor
  - 2. Anti-static
  - 3. Flammability Standard DOC-FF-1-70
- D. Basis of Design: Waterhog ECO Berber Section 09 06 00, SCHEDULE FOR FINISHES

**2.3 COVER SLEEVES FOR PIPE BOLLARDS**

- A. Material: Polyethylene
- B. Wall Thickness: 1/4 inch
- C. Color: Selected by Architect after Contract award from Manufacturer's standard choices
- D. Size: Fit Pipe Bollard as detailed.
- E. Mounting: Core-in.
- F. Extent of Work: Cover each Pipe Bollard shown on Drawings

**SECTION 10990  
MISCELLANEOUS SPECIALTIES**

**2.4 PROJECTION SCREENS**

- A. Screen Material: Fiberglass Matt White
- B. Size: As shown on Drawings
- C. Mounting: On Wall
- D. Operation: Motorized
- E. Control Switch:
  - 1. Type: 3-position Keyless
  - 2. Mounting: On Wall where located on Drawings
- F. Extent of Work: Provide where shown on Drawings.
- G. Basis of Design: DaLite Section 09 06 00, SCHEDULE FOR FINISHES

**2.5 BICYCLE RACKS**

- A. Material: Galvanized Steel
- B. Shape: Spiral-pulled spring
- C. Size: 1.25 inch pipe (1.66 inch OD)
- D. Material Finish: Powder-coated Enamel
- E. Color: Selected by Architect after Contract award from Manufacturer's standard choices
- F. Mounting: In-ground tap in anchors
- G. Bicycle Capacity per Rack: 6
- H. Extent of Work: Provide where shown on Drawings.
- I. Design Basis: Helix Rack by DERO Bike Racks Section 09 06 00, SCHEDULE FOR FINISHES

**2.6 SHOP PAINTING**

- A. Unless herein specified otherwise, factory-apply one coat Rust inhibiting Primer as specified in Section 09900 to Ferrous Metal surfaces after fabrication, but before installation.
- B. Substitute complete Factory-Finish where so specified herein.

**2.7 BLOCKING & BACKING**

- A. Provide where necessary.
- B. Specialties are shown on Drawings for Contractor's convenience. Verify location, type, and extent of Work before installing Blocking and Backing.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Blocking, Backing, and Surfaces to receive Specialties are properly prepared, sized, and located.
- B. Prior to starting Work notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect other materials against damage and discoloration caused by Work of this Section.



**SECTION 10990  
MISCELLANEOUS SPECIALTIES**

**PART 3 - EXECUTION**

**3.3 INSTALLATION**

- A. General:
  - 1. Follow Manufacturer's instructions and approved Shop Drawings.
  - 2. Secure Specialties plumb, level, square, and true as applicable.
  - 3. Entry Mats: Recess into Frame.
  - 4. Set Mat top flush with adjacent surface.
- B. Pipe Bollard Sleeves:
  - 1. Slide over Pipe Bollard, and anchor securely in place as instructed by Sleeve Manufacturer.
- C. Bicycle Racks:
  - 1. Anchor to adjacent construction as recommended by Manufacturer.
- D. Projection Screen:
  - 1. Anchor to adjacent construction as recommended by Manufacturer.
  - 2. Make Utility connections

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 CLEANING & REPAIRING**

- A. Remove Debris from Project Site upon Work completion, or sooner if directed.
- B. Including Work of other Sections, clean, repair and touch-up, or replace when directed, Products which have been soiled, discolored, or damaged by Work of this Section.
- C. Leave installation clean and defect-free.

**END OF SECTION**



**SECTION 11160  
LOADING DOCK EQUIPMENT**

**PART 1 - GENERAL**

**1.1 ALTERNATES**

- A. Refer to Section 01200 for possible effect upon Work of this Section.

**1.2 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.3 MANUFACTURER'S LITERATURE**

- A. Manufacturer's Printed data may be substituted provided required information is included.

**1.4 MANUFACTURER'S INSTALLATION INSTRUCTIONS**

- A. Prior to installation, submit 1 copy to Architect and General Contractor.

**1.5 MANUFACTURER'S OPERATING & MAINTENANCE INSTRUCTIONS**

- A. In accordance with Section 01830, submit to General Contractor for inclusion in Owner's Maintenance Manual.

**1.6 REGULATORY AGENCY REQUIREMENTS**

- A. Comply with Occupational Safety and Health Act and UL requirements.

**1.7 PRODUCT DELIVERY**

- A. Deliver with original, legible labels intact.

**1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

**PART 2 - PRODUCTS**

**2.1 DOCK LEVELOR**

- A. Type: Recessed, hydraulic, and adjustable.
- B. Platform:
  - 1. Surface: Diamond Checkered
  - 2. Size: See Drawings
- C. Minimum Live Load Capacity: 15,000 lbs.
- D. Minimum Vertical Movement: 24 inches
  - 1. Upward: 12 inches above Platform
  - 2. Downward: 12 inches below Platform
- E. Finish: Manufacturer's standard Rust-inhibiting Paint; 1-1/2 mil dry film minimum thickness.
- F. Label: Permanent type affixed in conspicuous location indicating:
  - 1. Live Load capacity
  - 2. Manufacturer's name, address, and phone number.
  - 3. Model
  - 4. Serial number

**SECTION 11160  
LOADING DOCK EQUIPMENT**

**PART 2 - PRODUCTS**

**2.1 DOCK LEVELOR (Cont)**

- G. Required Accessories:
  - 1. Wall-mounted Leveler Control Box with Automatic Night Lock to prevent unauthorized Leveler use.
  - 2. 16 inch (min.) Lip
  - 3. 4 inch (min.) Ramp Flex to compensate for unlevel Truck Beds
  - 4. Fixed Rear Hinges which do not project above adjacent Loading Dock surface
  - 5. Telescoping Toe Guards to close-off Leveler Sides
  - 6. Safety Switch to limit Leveler to 3 inches maximum free-fall.

**2.1 LOADING DOCK BUMPERS**

- A. Material: Laminated Rubberized-fabric
- B. Supports: Steel Angles
- C. Support Finish: Hot-dip galvanized  
Mounting: Horizontal
- D. Face Size: 10 x 24 inches
- E. Thickness: 6 inches
- F. Extent of Work: Provide where shown on Drawings.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Equipment are accurately sized and located, clean, and dry, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Secure Equipment plumb, level, square, straight, and true as applicable.
- C. Grout solidly around Equipment where shown on Drawings and where necessary.

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 PRODUCT CLEANING & REPAIRING**

- A. Including Work of other Trades, clean, repair and touch-up, or replace when directed, Products which have been soiled, discolored, or damaged by Work of this Section.
- B. Remove Debris from Project Site upon Work completion, or sooner if directed.

**SECTION 11160  
LOADING DOCK EQUIPMENT**

**PART 3 - EXECUTION**

**3.6 OPERATING DEMONSTRATION**

- A. Following installation and prior to final Project acceptance, demonstrate to Owner, in Architect's presence, Dock Leveler operation, by moving capacity load in and out when Leveler is in up, level, and down position.

**END OF SECTION**



**SECTION 11 19 00  
SAFETY PADDING EQUIPMENT**

**PART 1 - GENERAL**

**1.1 CONTRACT CONDITIONS**

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

**1.2 ALTERNATES**

- A. Refer to Section 01200 for possible effect upon Work of this Section.

**1.3 SYSTEM DESCRIPTION**

- A. Furnish and install protection padding (walls, floors, doors, frames and ceilings) in special rooms as indicated.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 SUBMITTALS**

- A. Manufacturer's Literature
  - 1. Show dimensions, required clearances, methods of joining to other Work, and other pertinent information.
  - 2. Manufacturer's Printed Data may be substituted provided required information is included. Approved, like-new Samples may be used on Project Work.
- B. Samples
  - 1. Include three (3) samples - minimum of 3"x3" in size - for approval and acceptance of protective padding system for use in safety rooms.
- C. Operating and Maintenance Data
  - 1. Include in Owner's Maintenance Manual.

**1.6 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Manufacturer.
  - 1. Because of the special nature of the work specified within this section, persons, firms or corporations desiring to bid on this section of work must meet the following requirements:
    - a. Have a minimum of five (5) years experience in the fabrication and installation of protective padding or work similar to that which is described herein.
    - b. Have ten (10) successful installations of protective pad

**SECTION 11 19 00  
SAFETY PADDING EQUIPMENT**

**1.7 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

**1.8 FIELD MEASUREMENTS**

- A. Verify prior to fabricating and installing Equipment.

**1.9 SPECIAL WARRANTY**

- A. Work specified herein subject to
- B. Protective Padding Contractor shall agree to repair or replace any defective material or work for a period of one (1) year from the date of project completion. This guarantee shall also include any loss of adhesion, resiliency or delaminating. This guarantee does not cover the damage caused by sharp or burning objects. This product is not intended to replace established management practices, but to supplement them in order to provide a safe environment for the end user, owner and client. Guarantee for this work shall be signed by both the Sub-Contractor and the General Contractor.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Protective padding material shall be a synthetic resinous material. Substitutions of a closed cell polyvinyl chloride or other types of polyvinyl chloride surfacing material will not be permitted
- B. All vertical panels shall be prefabricated. The panels are to be 1" nominal thickness Padding bonded on Oriented Strand Board 7/16" thickness, making the wall panels a total of 1-1/2" thick.
- C. The door jambs shall be 1/2" thickness Padding for a total of 1" thickness on door
- D. All floor panels shall be prefabricated. The panels are to be 3/4" Padding bonded on

**2.2 PROPERTIES**

- A. In addition to meeting the minimum physical properties when cured, protective padding must contain a flame spread and smoke index which when tested in accordance with ASTM E84 is given a CLASS A FIRE RATING.
  - 1. Flame Spread: 5
  - 2. Smoke Development:  $\leq 20$
- B. Padding must also conform to the following criteria:
  - 1. Weight is approximately 5 pounds per square foot
  - 2. Tensile strength range 300 P.S.I. minimum ASTM D412
- C. Temperature stability - unaffected from 20 degrees F to 120 degrees F
- D. Moisture absorption 0.8% to 1.05% by weight
- E. Compression set 90% recovery after 72 hours



**SECTION 11 19 00**  
**SAFETY PADDING EQUIPMENT**

**2.3 PROPERTIES (Cont)**

- F. Compression properties 30 PSI to 70 PSI at 50% modulus
- G. (7) Elongation at break ASTM D412: 150% typical
- H. Critical Radiant Flux of Floor Covering Systems ASTM E684: >0.99 (W/cm<sup>2</sup>) (Class I)
- I. Acute Oral Toxicity Test: Non Toxic
- J. Hardness: Durometer reading shall be 60 (plus or minus 5).
- K. Fungus Resistance MIL-I-531-D - Completely Resistant Rating (0.0.0)
  - 1. Fasteners for use in attachment of vertical panels shall be recommended by manufacturer

**PART 3 - EXECUTION**

**3.1 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.2 INSTALLATION**

- A. General
  - 1 Follow Manufacturer's instructions.
  - 2 Position plumb, level, square, straight, and true as applicable.
  - 3 Securely anchor to adjacent Construction.
- B. Inspect surface(s) to receive work under this section. Notify the architect in writing if surface(s) is not satisfactory for application of materials. Commencement of work constitutes acceptance of surface.
- C. All vertical panels will be mechanically fastened to walls.
- D. The number of fasteners per panel will be determined by the installers and is based on type of substrate.
- E. A gap of 1/8" ± 1/16" will be left between panels. They will then be filled with Gold Medal Compound. When fully cured, it will be sanded to meet adjacent edges.
- F. All fastener holes will be filled with Gold Medal Compound and sanded. Upon completion of sanding of all surfaces (walls, doors, ceiling and floor), all surfaces will receive a topcoat.

**3.3 PRECAUTIONS**

- A. The following conditions are required for the installation and storage of materials:
- B. General Contractor or owner shall provide adequate storage of materials.
- C. A minimum temperature of 65 degrees F shall be maintained for the duration of the installation.
- D. The General Contractor shall provide 120-volt electrical service, storage in a safe, warm and dry area, hoisting equipment and refuse receptacle

**SECTION 11 19 00  
SAFETY PADDING EQUIPMENT**

**3.4 PRODUCT CLEANING & REPAIRING**

- A. Including Work of other Trades, clean, repair and touch-up, or replace when directed, Products which have been soiled, discolored, or damaged by work of this Section.
- B. Remove Debris from Project Site upon work completion or sooner, if directed.

END OF SECTION

**SECTION 11 52 13**  
**PROJECTION SCREENS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Special Conditions and other Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Type A: Ceiling hung, permanently tensioned, electric operation projection screens with 94" diagonal viewing area (16:10 aspect ratio image size).
  - 2. All electronic screens shall be equipped with 24 volt wall mounted remote three-position control switch (Draper LVC-S or approved comparable product) with cover and plate located adjacent to the projection screen, along with low voltage interface (Draper LVC-III or approved comparable product) or approved comparable product) to audiovisual remote control systems.

**1.3 RELATED SECTIONS**

- A. Division 05 Section *Metal Fabrications* for support and hanging systems.
- B. Sections of Division 26 for electrical wiring, connections, and installation of control switches for electrically operated equipment.

**1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's specifications and installation instructions for each piece of equipment.
- B. Shop Drawings: Submit shop drawings for each type of equipment.

**1.5 QUALITY ASSURANCE**

- A. Obtain each type of equipment required from a single manufacturer as complete units, including necessary hardware and accessories.
- B. Measure gain of screen viewing surface against that of a magnesium carbonate surface by means of a photogoniometer using testing methods and test apparatus per FS GG-S-00172D (I) for determining the effect of reflected light at various viewing angles on screen surfaces.
- C. Provide screen fabrics identical to those materials which have undergone testing and passed requirements for flame resistance as outlined in NFPA 701 per small sample test.
- D. Provide a seamless mildew resistant screen fabric as determined by Federal Standard 191 A/5760.

**SECTION 11 52 13**  
**PROJECTION SCREENS**

**E. State of the Art Development**

1. Supply only the manufacturer's latest developed product. In cases where product development surpasses the criteria of the specification, inform the Architect and make the newer product available to the project at no additional cost. In no case shall discontinued or obsolete product be acceptable. The same requirement applies to software programs developed/updated during the warranty period.
2. Should the product recall by the manufacturer require temporary or permanent replacement of a product specified under this section, notify the Architect at the earliest reasonable time and arrange to replace the product in question at the earliest possible time.
  - a) Product found defective or subject to recall prior to scheduled installation shall not be delivered to the jobsite.
  - b) Product defect or intended recall shall not relieve the manufacturer from his contractual obligation with regard to delivery schedule of product.
  - c) Under no circumstances shall arrangement for alternate product necessarily require the Owner to accept superseded equipment except on a temporary basis.

**1.6 PROJECT CONDITIONS**

- A. Environmental Requirements: Comply with the manufacturers requirements for temperature and humidity conditions.

**PART 2 - PRODUCTS**

**2.1 AVAILABLE MANUFACTURERS**

- A. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work to include, but are not limited to, the following:
1. Electric projection screens:
    - a) Access V; Draper; Spiceland IN; 800-238-7999.
  2. Projection screen locations shall be in areas as indicated on "TA" Series drawings:
    - a) Type A: 94-inch (diagonal measure), 16:10 aspect ratio.

**2.2 MATERIALS AND FABRICATION**

- A. Provide each electrically operated, ceiling recessed front projection screens manufactured as an integral unit consisting of roller, screen fabric, finished retracting "trap-door" assembly, mounting accessories and all other components for a complete installation and complying with all requirements.
- B. The unit shall be UL-listed and bear UL re-examination markers. Screen limitation drop, or permanent mounting position, will position the bottom of the displayed image as listed below. Verify drop distance with ceiling height information prior to ordering equipment.
- a) Type A: 48-inches above finish floor.

**SECTION 11 52 13  
PROJECTION SCREENS**

- C. Fabric: The image area shall be a completely seamless, polyvinyl, white fabric with a gain of 1.0 to 1.3. It shall have a black border, black backing and be cable-tensioned to eliminate edge curl, sag, and center wrinkle; equivalent to M1300 by Draper.
- D. Case: Aluminum or steel, and fire-retardant hardboard, with removable access panels on the bottom or side of the case. The unit shall have an integral motorized trap door. The case shall be finished to match ceiling.
- E. Motor: Size and capacity as recommended by the manufacturer for the screen. Provide an instant reversing, gear driven, or in roller, motor with permanently lubricated ball bearings, automatic thermal overload protection, and preset limit switches to automatically stop the screen in the fully "UP" or "DOWN" position. The stop action shall be positive to prevent coasting. The motor shall be acoustically isolated to limit operating noise.
- F. Control: Provide low voltage (24 volts or less) controls wired to a junction box on the screen wall and to the associated audiovisual equipment rack. The wall plate shall have push button control for "UP", "DOWN", and "STOP". The same control functions shall be present at the junction box in the audiovisual control system.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install equipment at locations indicated in compliance with the manufacturer's instructions, including, but not limited to, Installation Instructions.
- B. Install in position and relationship to adjoining work indicated, securely anchored to supporting substrate, sealed and finished, and in a manner, which produces a smooth screen with square, plumb, and straight edges.
- C. Install with proper clearance between the gypsum board, the ceiling tiles, the screen, and the jam. Electric screens are to be installed with housing (case) concealed just above room ceiling tiles. Provide cutout opening with finish in drop tile or hard ceiling for screen drop.
- D. The equipment shall be inspected upon arrival to the job site. The equipment shall be stored in their original crates until installation.

**3.2 ADJUST AND CLEAN**

- A. Protect equipment after installation from damage during construction including, but not limited to, paint, scratches, and dirt. If, despite such protection, damage occurs, remove and replace damaged components or entire unit as required to restore units to their original, undamaged condition.
- B. Adjust assembly after installation for proper operation and screen drop/ retract.

**END OF SECTION 11 52 13**



**SECTION 12 24 00  
WINDOW SHADES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Cloth shades, are specified in this section. Window shades shall be furnished complete, including brackets, fittings and hardware.

**1.2 RELATED WORK**

- A. Color of shade cloth : Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
1. Shade cloth, each type, 600 mm (24 inch) square, including cord and ring, showing color, finish and texture.
- C. Manufacturer's literature and data; showing details of construction and hardware for:  
Cloth and window shades

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced to in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
- AA-V-00200B ..... Venetian Blinds, Shade, Roller, Window, Roller, Slat, Cord, and Accessories
- C. American Society for Testing and Materials (ASTM):
- B221/B221M-08 ..... Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- D635-10 ..... Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
- D648-07 ..... Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
- D1784-08 ..... Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

**SECTION 12 24 00  
WINDOW SHADES**

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Shade Cloth: opaque.
- B. Staples (For Cloth Window Shades): Nonferrous metal or zinc-coated steel.
- C. Stainless Steel: ASTM A167

**2.2 FASTENINGS**

Zinc-coated or cadmium plated metal, aluminum or stainless steel fastenings of proper length and type. Except as otherwise specified, fastenings for use with various structural materials shall be as follows:

Type of Fastening	Structural Material
Wood screw	Wood
Tap screw	Metal
Case-hardened, self-tapping screw	Sheet Metal
Screw or bolt in expansion shields	Solid masonry
Toggle bolts	Hollow blocks, wallboard and plaster

**2.3 FABRICATION**

- A. Fabricate cloth shades to fit measurements of finished openings obtained at site.
- B. Cloth Window Shades: Rolling type, constructed of shade cloth mounted on rollers.  
Shade cloth shall have plain sides, and with hem at bottom to accommodate wood slat. Separate shades are required for each individual sash within opening. Length of shades shall exceed height of window approximately 300 mm (12 inches) measured from head to sill, in addition to material required to make-up hem:
  - 1. Provide rollers with spindles, nylon bearings, tempered steel springs, and all other related accessories required for positive action. Provide rollers of diameter recommended by shade manufacturer. Staple shade cloth to wood rollers to prevent wrinkling or folding, and on line parallel to axis of rollers so that shade will hang



**SECTION 12 24 00  
WINDOW SHADES**

- plumb. Space staples not over 90 mm (3-1/2 inches) on centers. Use of tacks is prohibited.
2. Wood slats shall be smooth, tapered, and inserted in the bottom hem of the shade cloth.
  3. Eyelets shall have clear openings large enough to accommodate cords. Edges of eyelets shall not cut into cloth when set.
  4. Cords shall be of sufficient length to permit shades to be drawn to bottom of opening with ends looped and held with cord rings. Attach cords to hems through metal eyelets in center of slats in bottom hems.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Cloth Window Shades: Mount window shades on end of face brackets, set on metal gussets, or casing of windows as required. Provide extension face brackets where necessary at mullions.
1. Locate rollers in level position as high as practicable at heads of windows to prevent infiltration of light over rollers.
  2. Where extension brackets are necessary, on mullions or elsewhere, for alignment of shades, provide metal lugs, and rigidly anchor lugs and brackets.
  3. Place brackets and rollers so that shades will not interfere with window and screen hardware.
  4. Mount shades at detention, or protection screens on head rail (room side) of hinged frame, with face brackets located approximately 38 mm (1-1/2 inches) from outside edges.
  5. Shade installation methods not specifically described, are subject to approval of Resident Engineer.
  6. Install shades and shade assembly to eliminate all light from coming thru opening.

- - - E N D - - -



**SECTION 12 24 21  
LIGHTPROOF SHADES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Provide lightproof shades where indicated, manual function.

**1.2 RELATED WORK**

SECTION 12 24 00, WINDOW SHADES.

**1.3 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Manufacturers' Literature and Data: Showing details of construction and hardware for Lightproof Shades.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):  
A-A-59517 ..... Cloth, Coated or Laminated, Polyvinylchloride (Artificial Leather)

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Shade Cloth: Fabricate for a crackproof and fadeproof material that will remain soft and pliable at all times under temperature changes. Shade cloth shall conform to fire resistant requirement of Fed. Spec. A-A-59517, and shall be same color on both sides.
- B. Cords for Shades: No. 4 braided nylon, or No. 4 1/2 braided cotton having not less than 80 Kg (175 pounds) breaking strength.
- C. Roller Assembly: Ball Bearing, Steel Roller with heavy oiled-tempered steel spring.
- D. Housing: Square Steel with baked enamel finish- interior black and exterior to match shade cloth.
- E. Side Guides: Steel, light proof, shape and size required by conditions of use, match roller finish.
- F. Operating bar: Steel with spring catches on each side with resilient Sill contact strip
- G. Fastenings: Zinc-coated or cadmium plated metal, aluminum or stainless steel fastenings of proper length and type. Except as otherwise specified, fastenings for use with various structural materials shall be as follows:

**SECTION 12 24 21  
LIGHTPROOF SHADES**

Type of Fastening	Structural Material
Wood screw	Wood
Tap Screw	Metal
Case-hardened, self-tapping screw	Solid masonry Sheet metal
Toggle bolts	Hollow blocks, wallboard plaster

## **2.2 SHADES ENCLOSED IN WINDOWS**

Shades inside of windows panes shall be used at Mental Health and Behavioral Nursing Units. There shall be no cords or ropes attached and curtains shall not be used. Hardware should be flush with the walls so that it can't be used to secure a nose. Hardware should also be tamper proof to prevent removal for use as a weapon or for self harm.

## **2.3 FABRICATION**

- A. Lightproof shades shall be metal head housing, deep side guides, sill light lock members, continuous metal jamb and head anchor section, operating bars, and shall be complete with roller assembly, one piece lightproof shade cloth, and metal disappearing type horizontal braces (two each shade).
- B. Light traps shall be shop fabricated, and shall consist of a head box to house the shade roller, and steel channels U-shape in cross section to serve as guides for the shade along the sides, and to receive the bottom edge of the shade along the sill. Make light trap of sheet steel having a minimum thickness of 0.38 mm (0.015). Legs of the U-shaped channels shall be, not less than 45 mm (1-3/4 inches) long and separated by minimum distance that will permit free operation of the shade. Edges of light trap coming into contact with the shade cloth shall be rounded or beaded. Exposed face of the head box shall be hinged, or removable for access to the shade roller. Design entire assembly to prevent light from entering the room when the shade is drawn. Interior or unexposed surfaces of the light trap shall have a finish coat of flat black enamel. Exposed portions of the light trap shall have a factory applied pyroxylin lacquer, or baked on enamel finish in color to match adjoining wood or metal work.
- C. Rollers shall be of sufficient diameter to support the shade, and provided with spindles, bearings and coil springs. Provide rollers with a groove and metal spline with machine screws spaced not over nine inches on centers, for attaching the shade cloth.
- D. Shades not finished with a selvage shall have vertical edges bound or hemmed to prevent raveling. Sewing shall be double or triple stitched, using a high-grade thread. Make needle holes lightproof by applying a suitable filler.
- E. Stiffen the shade by transverse steel bars of size and weight to hold the shade in the channel guides. Space bars approximately 450 mm (18 inches) on centers and conceal in pockets in the shade. Fit bottom edge of the shade with a steel operating bar designed to engage the sill channel of the light trap. Paint bars with flat black enamel.
- F. Cords: Fit operating bar with pull cord.

**SECTION 12 24 21**  
**LIGHTPROOF SHADES**

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

Install lightproof shades level at a height that will permit proper operation of the shades, and prevent outside light from infiltrating into the room. Light traps shall be closely fitted to the adjacent construction, and the connection shall be rigid and light-tight. Shades shall not be installed until after the room painting and finishing operations are complete.

- E N D - -



**SECTION 12 36 00  
COUNTERTOPS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies casework countertops with integral accessories.

**1.2 RELATED WORK**

- A. Color and patterns of plastic laminate: SECTION 09 06 00, SCHEDULE FOR FINISHES.  
B. DIVISION 22, PLUMBING.  
C. DIVISION 26, ELECTRICAL.

**1.3 SUBMITTALS**

- A. Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.  
B. Shop Drawings  
1. Show dimensions of section and method of assembly.  
2. Show details of construction at 1/2 scale.  
C. Samples:  
1. 150 mm (6 inch) square samples each top.  
2. Front edge, back splash, end splash and core with surface material and booking.

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.  
B. American Hardboard Association (AHA):  
A135.4-95 ..... Basic Hardboard  
C. Composite Panel Association (CPA):  
A208.1-09 ..... Particleboard  
D. American Society of Mechanical Engineers (ASME):  
A112.18.1-05 ..... Plumbing Supply Fittings  
A112.1.2-04 ..... Air Gaps in Plumbing System  
E. American Society for Testing and Materials (ASTM):  
D256-06 ..... Pendulum Impact Resistance of Plastic  
D570-98(R2005) ..... Water Absorption of Plastics  
D638-08 ..... Tensile Properties of Plastics  
D785-08 ..... Rockwell Hardness of Plastics and Electrical Insulating Materials  
D790-07 ..... Flexural Properties of Unreinforced and Reinforced  
Plastics and Electrical Insulating Materials  
F. Federal Specifications (FS):  
A-A-1936 ..... Adhesive, Contact, Neoprene Rubber  
G. U.S. Department of Commerce, Product Standards (PS):  
PS 1-95 ..... Construction and Industrial Plywood  
H. National Electrical Manufacturers Association (NEMA):  
LD 3-05 ..... High Pressure Decorative Laminates  
LD 3.1-95 ..... Performance, Application, Fabrication, and Installation of  
High Pressure Decorative Laminates

**SECTION 12 36 00  
COUNTERTOPS**

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Plastic Laminate: NEMA LD 3.
  - 1. Concealed backing sheet Type BKL.
  - 2. Decorative surfaces:
    - a. Flat components: Type GP-HGL.
- C. Particleboard: CPA A208.1, Grade 2-M-2.
- D. Plywood: PS 1, Exterior type, veneer grade AC not less than five ply construction.
- E. Hardboard: ANSI/AHA A135.4, Type I, tempered, fire retardant treated, smooth surface one side.
- F. Adhesive
  - 1. For plastic laminate FS A-A-1936.
  - 2. For wood products: ASTM D4690, unextended urea resin or unextended melamine resin, phenol resin, or resorcinol resin.
  - 3. For Field Joints:
    - a. Epoxy type, resistant to chemicals as specified for plastic laminate laboratory surfaces.
    - b. Fungi resistant: ASTM G-21, rating of 0.
- G. Fasteners:
  - 1. Use studs, bolts, spaces, threaded rods with nuts or screws suitable for materials being joined with metal splice plates, channels or other supporting shape.
- H. Solid Polymer Material:
  - 1. Filled Methyl Methacrylic Polymer.
  - 2. Performance properties required:

Property	Result	Test
Elongation	0.3% min.	ASTM D638
Hardness	90 Rockwell M	ASTM D785
Gloss (60° Gordon)	5-20	NEMA LD3.1
Color stability	No change	NEMA LD3 except 200 hour
Abrasion resistance	No loss of pattern Max wear depth 0.0762 mm (0.003 in) - 10000 cycles	NEMA LD3
Water absorption weight (5 max)	24 hours 0.9	ASTM D-570
Izod impact	14 N m/m (0.25 ft-lb/in)	ASTM D256 (Method A)
Impact resistance	No fracture	NEMA LD-3 900 mm (36") drop 1 kg (2 lb.) ball
Boiling water surface resistance	No visible change	NEMA LD3



**SECTION 12 36 00  
COUNTERTOPS**

Property	Result	Test
High temperature resistance	Slight surface dulling	NEMA LD3

3. Cast into sheet form
4. Color throughout with subtle veining through thickness.
5. Joint adhesive and sealer: Manufacturers silicone adhesive and sealant for joining methyl methacrylic polymer sheet.
6. Bio-based products will be preferred
7. Design Basis: Corian by DuPont see Section 09 06 00, SCHEDULE FOR FINISHES

**I. Quartz polymer**

- 1.. Performance properties required:

Property	Result	Test
Elongation	0.3% min.	ASTM D638
Hardness	7	Mohs Hardness Test
Gloss (60° Gordon)	45-50	ANZ Z124
Color stability	No change	ANZI Z124.6.5.1
Abrasion resistance	139	ASTM C 501
Water absorption weight (5 max)	0.12%	ASTM C-373
Impact resistance	No fracture	ANZI Z124.6.4.2
Boiling water surface resistance	No visible change	NEMA LD3.3.5
High temperature resistance	Non to Slight effect	NEMA LD3.3.6

2. Cast into sheet form
3. Color throughout with subtle veining through thickness.
4. Joint adhesive and sealer: Manufacturers silicone adhesive and sealant for joining homogeneous quartz polymer sheet.
5. Bio-based products will be preferred
6. Design Basis: Zodiaq by DuPont see Section 09 06 00, SCHEDULE FOR FINISHES

**2.3 ELECTRICAL RECEPTACLES**

- A. per electrical specifications.
- B. Curb Mounted Receptacles:
  1. NEMA 5-20R duplex in galvanized steel box.
  2. Chromium plated brass or steel face plate.

**SECTION 12 36 00  
COUNTERTOPS**

**2.4 COUNTERTOPS**

- A. Fabricate in largest sections practicable.
- B. Fabricate with joints flush on top surface.
- C. Fabricate countertops to overhang front of cabinets and end of assemblies 25 mm (one inch) except where against walls or cabinets.
- D. Provide 1 mm (0.039 inch) thick metal plate connectors or fastening devices (except epoxy resin tops).
- E. Join edges in a chemical resistant waterproof cement or epoxy cement, except weld metal tops.
- F. Fabricate with end splashes where against walls or cabinets where detailed.
- G. Splash Backs and End Splashes:
  - 1. Not less than 19 mm (3/4 inch) thick.
  - 2. Height 100 mm (4 inches) unless noted otherwise.
  - 3. Laboratories and pharmacy heights or where fixtures or outlets occur: Not less than 150 mm (6 inches) unless noted otherwise.
  - 4. Fabricate epoxy splash back in maximum lengths practical of the same material.
- H. Drill or cutout for sinks, and penetrations.
  - 1. Accurately cut for size of penetration.
- I. Plastic Laminate Countertops:
  - 1. Fabricate plastic laminate on five-ply plywood or particleboard core 19 mm (3/4 inch) thick with plastic laminate backing sheet.
  - 2. Front edge over cabinets not less than 38 mm (1-1/2 inches) thick except where plastic "T" insert is used, not less than 19 mm (3/4 inch) thick.
  - 3. Exposed Surface and edges of decorative laminated plastic or laboratory chemical resistant surface.
    - a. Use chemical resistant surface on tops 6A, 6B, and 6C.
    - b. Use decorative surface tops when noted plastic laminate, for tops 10A, 10B and 10C.
- J. Molded Resin Tops:
  - 1. Molded resin with drip groove cut on underside of overhanging edge.
  - 2. Finish thickness of top minimum 25 mm (1 inch).
  - 3. Joints: Epoxy Type.
  - 4. Secure reagent shelves to counter tops with fasteners from underside and seal seam.
- K. Methyl Methacrylic Polymer Tops:
  - 1. Fabricate countertop of methyl methacrylic polymer cast sheet, 19 mm (3/4 inch) thick.
  - 2. Fabricate back splash and end splash to height shown.
  - 3. Fabricate with marine edge where sinks occur.
  - 4. Fabricate in one piece for full length from corner to corner up to 3600 mm (12 feet).
  - 5. Join pieces with adhesive sealant.
  - 6. Cut out countertop for lavatories, plumbing trim.
  - 7. Provide concealed fasteners and epoxy cement for anchorage of sinks to countertop.

**SECTION 12 36 00  
COUNTERTOPS**

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Before installing countertops verify that wall surfaces have been finished as specified and that mechanical and electrical service locations are as required.
- B. Secure countertops to supporting rails of cabinets with metal fastening devices, or screws through pierced slots in rails.
  - 1. Where type, size or spacing of fastenings is not shown or specified, submit shop drawings showing proposed fastenings and method of installation.
  - 2. Use round head bolts or screws.
  - 3. Use epoxy or silicone to fasten the epoxy resin countertops to the cabinets.
  - 4. Use wood or sheet metal screws for wood or plastic laminate tops; minimum penetration into top 16 mm (5/8 inch), screw size No 8, or 10.

**3.2 PROTECTION AND CLEANING**

- A. Tightly cover and protect against dirt, water, and chemical or mechanical injury.
- B. Clean at completion of work.

- - - E N D - - -



SECTION 12 93 00  
SITE FURNISHINGS

**PART 1 - GENERAL**

**1.1 SUMMARY:**

A Work of this Section includes the following: Provide all labor, materials, equipment and services necessary for the proper and complete installation of the following:

1. Rounded River Rock – Dry Stream Channel
2. Pebble Tile – Patient Garden Walkway Feature
3. Spherical Water Fountain
4. Water Wall Water Feature
5. Benches
6. Picnic Table
7. Trash Receptacles
8. Bollard
9. Bicycle Rack
10. Landscape Pavers

**1.2 SUBMITTALS:**

A. Submit the following in accordance with the requirements of Section 013300:

1. Shop Drawings: Submit product brochures, color samples and warranty and installation information.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

A. Rounded River Rock – Dry Stream Channel

1. Washed, clean, durable, unbroken.
2. Size range: 4" -8" from approved local sources.
3. Material: Columbia River Rock.

B. Pebble Tile – Patient Garden

1. Manufacturer: Coverall Stone Inc. [www.coverallstone.com](http://www.coverallstone.com)
  - a. Seaside Pebble Tile, Seaside Earth PT-S-EA, Interlocking tiles of 1-2" dia. pebbles adhered to 12"x 12" mesh backing.
  - b. Thin set mortar
  - c. Natural stone and grout sealer
  - d. Sanded Grout

C. Spherical Water Fountain

1. Manufacturer: Water Fountains Inc. [www.waterfountains.com](http://www.waterfountains.com)

SECTION 12 93 00  
SITE FURNISHINGS

- a. Model: 36" 304-SS (1.5 mm) polished by hand tools, fountain with internal 63mm Stainless Steel 12" external 63 mm SS tube with 12"x12" square 304-SS support base (or approved equal).
  - b. Submersible pump: 1/3 hp 115v submersible pump, top discharge, 40 gal./min. capacity, lightweight durable stainless steel casing, automatic non-mercury float switch, rated for continuous use. Or approved equal.
  - c. Tree grate: Standard Flat - 3 foot round cast aluminum, with center hole diameter 4" dia. With mounting rim and securing bolt downs as manufactured by Urban Accessories or equal. [www.urbanaccessories.com](http://www.urbanaccessories.com)
2. Number of Units: one (1).
3. Substitutions: Under provisions of Section 01 60 00.
- D. Water Wall Feature: See Drawings for Concept Plans
1. Manufacturer: Water Studio Inc., 5681 Selmaraine Drive, Culver City, CA 90230 USA, [info@wstudio.com](mailto:info@wstudio.com), Phone (310) 581-2221. Or approved equal.
    - a. Conceptual Plans to be brought to full shop drawings (See Drawings).
    - b. Materials approved by Landscape Architect
2. Number of Units: one (1).
3. Substitutions: Under provisions of Section 01 60 00.
- E. Patient Garden Benches:
1. Manufacturer: Reclaimed Recycled Products
    - a. Model: I-Bench – 6' Reclaimed Fir Wood w/ recycled steel I-beam pedestals, powder coated black. surface mount.
  - b. Number of Units: 2
- F. Site Benches:
1. Manufacturer: Urbanscape Furniture
    - a. Model: WO1112S – Woodridge 6' bench with back with arms, faux-wood italia, frame powder-coated stainless. Surface mount.
  2. Number of Units: See plans.
  3. Substitutions: Under provisions of Section 01 60 00.
- G. Trash Receptacles:
1. Manufacturer: Urbanscape Furniture
    - a. Model: WO3F32S – Receptacle with liner and flat-top lid, faux-wood italia. Surface mount.
  2. Number of Units: 3
- H. Staff Garden Picnic Table:
1. Manufacturer: Victor Stanley
    - a. Model: CP-4 – Homestead Series 3 ft. square top, 2nd Site Systems® reinforced recycled plastic slats, Maple color.
    - b. 4-inch square structural steel center post
    - c. Standard In-Ground mount.

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SITE FURNISHINGS

- 2. Number of Units: 3
- I. Bollard:
  - 1. Manufacturer: Wausau Tile
    - a. Model: TF6010
    - b. 12" dia. X 30", color: B-4 Weatherstone (Buff)
    - c. Permanently embedded, see plans.
  - 2. Number of Units: 17
- J. Bicycle Rack:
  - 1. Manufacturer: DuMor Site Furnishings
    - a. Model: 125-40
    - b. 2-7/8" o.d. schedule 40 steel pipe, powder coated black, surface mount.
- K. Landscape Pavers:
  - 1. Manufacturer: Mutual Materials
    - a. Model: Vancouver Bay Series 24 x 24
    - b. Color: Latte
    - c. Finish: Light shot-blast

**PART 3 - EXECUTION**

**3.1 PREPARATION:**

- A. Obtain Landscape Architect/Engineer approval as to exact location prior to site installation for all elements listed here.
- B. Provide to Landscape Architect one 24" square mock-up of Pebble Tile installation for approval prior to installation on site.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate Sections.
- C. Use care in loading and unloading rocks to avoid chipping, abrasions, cracking or other defects. Remove damaged material from site and replace as directed.

**3.2 INSTALLATION:**

- A. Install items per construction document details.
- B. Install items plumb and level, accurately fitted, free from distortion or defects.
- C. Install all products according to manufacturer's recommendations.
- D. Secure as specified or as recommended by manufacturer. Obtain Owner' Authorized Representative approval of method prior to installation.
- E. After installation, touch up scratched or damaged surfaces according to manufacturer's directions.

**3.3 PROTECTION AND CLEANING**

SECTION 12 93 00  
SITE FURNISHINGS

- A. After installation, all surfaces of installed products shall be cleaned of mortar, concrete, paint or other contaminants. After cleaning, all work shall be protected against damage until final acceptance by Owner. Damaged surfaces shall be repaired or replaced as directed by Architect and at no cost to the Owner.
- B. Any surplus material and debris remaining after construction work is completed shall be removed from the site.

END OF SECTION



**SECTION 13 05 41**  
**SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. Provide seismic restraint in accordance with the requirements of this section in order to maintain the integrity of nonstructural components of the building so that they remain safe and functional in case of seismic event.
- B. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include:
  - 1. Architectural Elements: Facades that are not part of the structural system and its shear resistant elements; cornices and other architectural projections and parapets that do not function structurally; glazing; nonbearing partitions; suspended ceilings; stairs isolated from the basic structure; cabinets; bookshelves; medical equipment; and storage racks.
  - 2. Electrical Elements: Power and lighting systems; substations; switchgear and switchboards; auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems.
  - 3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems; boiler equipment and components.
  - 4. Transportation Elements: Mechanical, electrical and structural elements for transport systems, i.e., elevators and dumbwaiters, including hoisting equipment and counterweights.

**1.3 QUALITY CONTROL:**

- A. Shop-Drawing Preparation:
  - 1. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. The professional structural engineer shall be registered in the state where the project is located.
  - 2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State where project is located.
- B. Coordination:
  - 1. Do not install seismic restraints until seismic restraint submittals are approved by the Resident Engineer.
  - 2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.
- C. Seismic Certification:

In structures assigned to IBC Seismic Design Category C, D, E, or F, permanent equipments and components are to have Special Seismic Certification in accordance with requirements of section

**SECTION 13 05 41**  
**SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS**

13.2.2 of ASCE 7 except for equipment that are considered rugged as listed in section 2.2 OSHPD code application notice CAN No. 2-1708A.5, and shall comply with section 13.2.6 of ASCE 7.

**1.4 SUBMITTALS:**

- A. Submit a coordinated set of equipment anchorage drawings prior to installation including:
  - 1. Description, layout, and location of items to be anchored or braced with anchorage or brace points noted and dimensioned.
  - 2. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified.
  - 3. Numerical value of design seismic brace loads.
  - 4. For expansion bolts, include design load and capacity if different from those specified.
- B. Submit prior to installation, a coordinated set of bracing drawings for seismic protection of piping, with data identifying the various support-to-structure connections and seismic bracing structural connections, include:
  - 1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.
  - 2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
  - 3. Pipe contents.
  - 4. Structural framing.
  - 5. Location of all gravity load pipe supports and spacing requirements.
  - 6. Numerical value of gravity load reactions.
  - 7. Location of all seismic bracing.
  - 8. Numerical value of applied seismic brace loads.
  - 9. Type of connection (Vertical support, vertical support with seismic brace etc.).
  - 10. Seismic brace reaction type (tension or compression): Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.
- C. Submit prior to installation, bracing drawings for seismic protection of suspended ductwork and suspended electrical and communication cables, include:
  - 1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
  - 2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
  - 3. Maximum spacing of hangers and bracing.
  - 4. Seal of registered structural engineer responsible for design.

**SECTION 13 05 41**  
**SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS**

- D. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraph 1.3A.
- E. Submit for concrete anchors, the appropriate ICBC evaluation reports, OSHPD pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.

**1.5 APPLICABLE PUBLICATIONS:**

- A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
  - 355.2-07 .....Qualification for Post-Installed Mechanical Anchors in Concrete and Commentary
- C. American Institute of Steel Construction (AISC):
  - Load and Resistance Factor Design, Volume 1, Second Edition
- D. American Society for Testing and Materials (ASTM):
  - A36/ A36M-08 .....Standard Specification for Carbon Structural Steel
  - A53/ A53M-10 .....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - A307-10 .....Standard Specification for Carbon Steel Bolts and Studs; 60,000 PSI Tensile Strength.
  - A325-10 .....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
  - A325M-09 .....Standard Specification for High-Strength Bolts for Structural Steel Joints [Metric]
  - A490-10 .....Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
  - A490M-10 .....Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric]
  - A500/ A500M-10 .....Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
  - A501-07 .....Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
  - A615/ A615M-09 .....Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  - A992/ A992M-06 .....Standard Specification for Steel for Structural Shapes for Use in Building Framing

**SECTION 13 05 41**  
**SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS**

A996/A996M-09.....Standard Specification for Rail-Steel and Axel-Steel Deformed  
Bars for Concrete Reinforcement

E488-96(R2003).....Standard Test Method for Strength of Anchors in Concrete and  
Masonry Element

- E. American Society of Civil Engineers (ASCE 7) Latest Edition.
- F. International Building Code (IBC) Latest Edition
- G. VA Seismic Design Requirements, H-18-8, February 2011
- H. National Uniform Seismic Installation Guidelines (NUSIG)
- I. Sheet Metal and Air Conditioning Contractors National Association  
(SMACNA): Seismic Restraint Manual - Guidelines for Mechanical Systems, 1998 Edition and  
Addendum

**1.6 REGULATORY REQUIREMENT:**

- A. IBC 2003.
- B. Exceptions: The seismic restraint of the following items may be omitted:
  - 1. Equipment weighing less than 400 pounds, which is supported directly on the floor or roof.
  - 2. Equipment weighing less than 20 pounds, which is suspended from the roof or floor or hung from a wall.
  - 3. Gas and medical piping less than 2 ½ inches inside diameter.
  - 4. Piping in boiler plants and equipment rooms less than 1 ¼ inches inside diameter.
  - 5. All other piping less than 2 ½ inches inside diameter, except for automatic fire suppression systems.
  - 6. All piping suspended by individual hangers, 12 inches or less in length from the top of pipe to the bottom of the support for the hanger.
  - 7. All electrical conduits, less than 2 ½ inches inside diameter.
  - 8. All rectangular air handling ducts less than six square feet in cross sectional area.
  - 9. All round air handling ducts less than 28 inches in diameter.
  - 10. All ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of support for the hanger.

**PART 2 - PRODUCTS**

**2.1 STEEL:**

- A. Structural Steel: ASTM A36 // A36M // A992 //.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53/A53M, Grade B.
- E. Bolts & Nuts: ASTM // A307 // A325 // A325M // A490 // A490M //.

**SECTION 13 05 41**  
**SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS**

**2.2 CAST-IN-PLACE CONCRETE:**

- A. Concrete: 28 day strength,  $f'_c = //$  25 MPa (3,000 psi)  $//$  30 MPa (4,000 psi)  $//$  xx MPa 5000 psi
- B. Reinforcing Steel: ASTM A615/615M or ASTM A996/A996M deformed.

**PART 3 - EXECUTION**

**3.1 CONSTRUCTION, GENERAL:**

- A. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.
- B. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.
- C. Construct seismic restraints and anchorage to allow for thermal expansion.
- D. Testing Before Final Inspection:
  - 1. Test 10-percent of anchors in masonry and concrete per ASTM E488, and ACI 355.2 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.
  - 2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.

**3.2 EQUIPMENT RESTRAINT AND BRACING:**

- A. See drawings for equipment to be restrained or braced.

**3.3 MECHANICAL DUCTWORK AND PIPING; BOILER PLANT STACKS AND BREACHING;  
ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION  
WIRES AND CABLE TRAYS**

- A. Support and brace mechanical ductwork and piping; electrical busways, conduits and cable trays; and telecommunication wires and cable trays including boiler plant stacks and breeching to resist directional forces (lateral, longitudinal and vertical).
- B. Brace duct and breeching branches with a minimum of 1 brace per branch.
- D. Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.
- E. Seismic Restraint of Piping:
  - 1. Design criteria:
    - a. Piping resiliently supported: Restrain to support  $//$  120  $//$  -percent of the weight of the systems and components and contents.
    - b. Piping not resiliently supported: Restrain to support  $//$  60  $//$  -percent of the weight of the system components and contents.

**SECTION 13 05 41**  
**SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS**

//2. Provide seismic restraints according to one of the following options:

- F. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

**3.4 PARTITIONS**

- A. In buildings with flexible structural frames, anchor partitions to only structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.
- B. Properly anchor masonry walls to the structure for restraint, so as to carry lateral loads imposed due to earthquake along with their own weight and other lateral forces.

**3.5 CEILINGS AND LIGHTING FIXTURES**

- A. At regular intervals, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.
- B. Independently support and laterally brace all lighting fixtures. Refer to applicable portion of lighting specification, Section 26 51 00, INTERIOR LIGHTING.

**3.6 FACADES AND GLAZING**

- A. Do not install concrete masonry unit filler walls in a manner that can restrain the lateral deflection of the building frame. Provide a gap with adequately sized resilient filler to separate the structural frame from the non-structural filler wall.
- B. Tie brick veneers to a separate wall that is independent of the steel frame as shown on construction drawings to ensure strength against applicable seismic forces at the project location.
- C. Install attachments to structure for all façade materials as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

**3.7 STORAGE RACKS, CABINETS, AND BOOKCASES**

- A. Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.
- B. Anchor medical supply cabinets to the floor or walls and equip them with properly engaged, lockable latches.
- C. Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.
- D. Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

--- E N D ---